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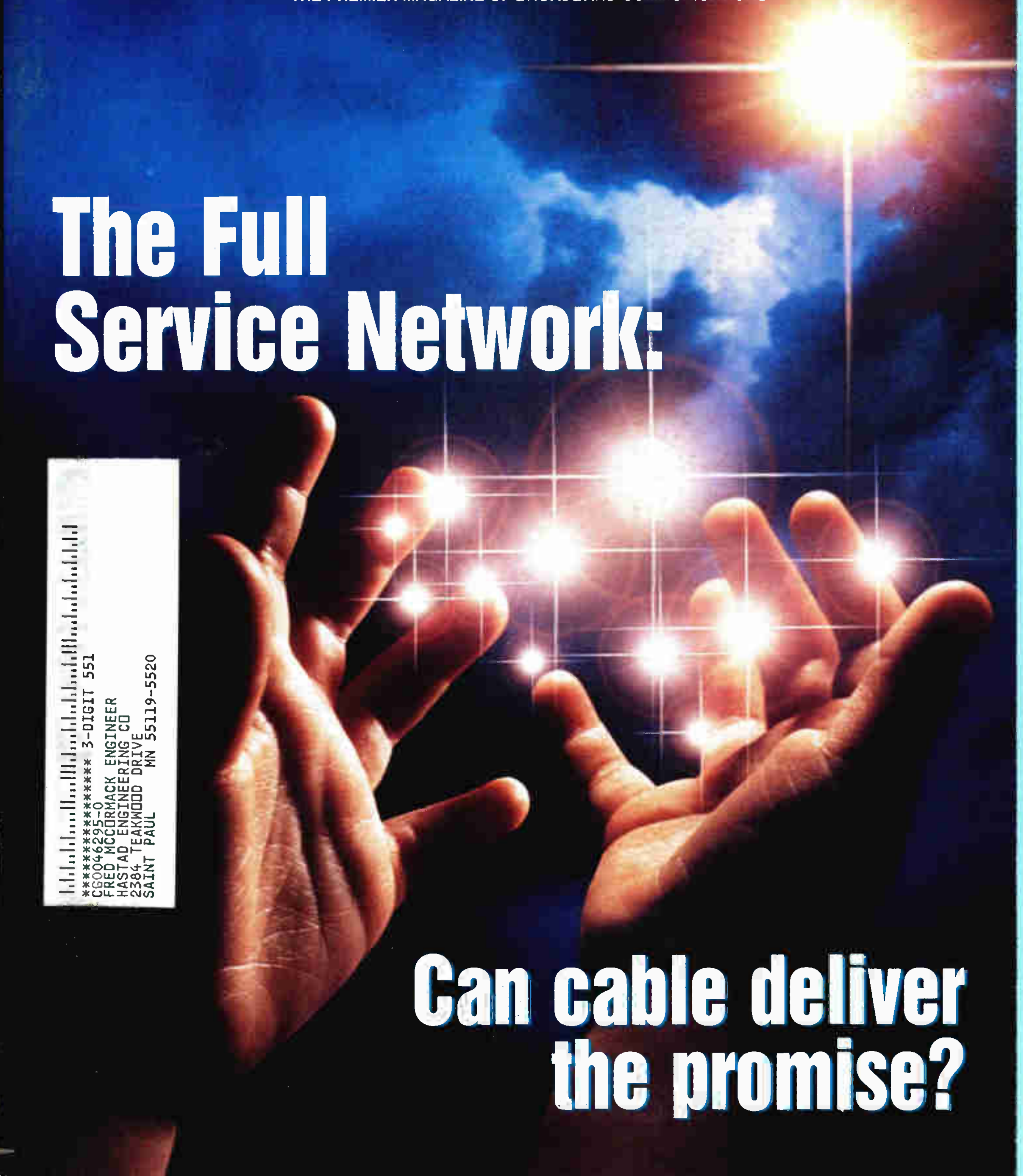
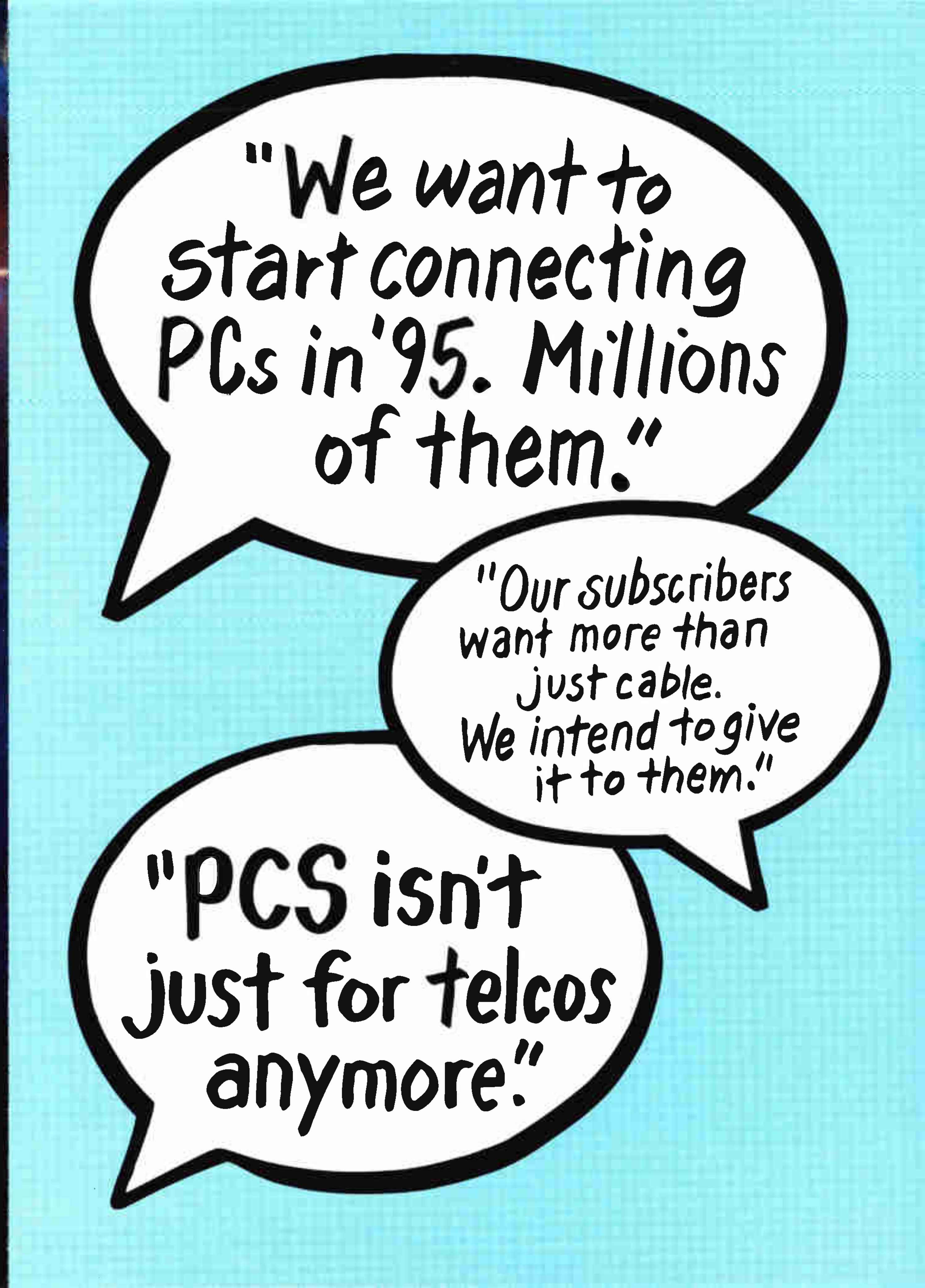


The Full Service Network:

Can cable deliver the promise?



A cold splash of water

As cable operators move into a new era of competitive pressures, they're being bombarded with information from an ever-expanding list of sources. During times like these, it's difficult to separate fact from fiction, reality from hyperbole.

A new report, written by an impressive study team, provides an interesting perspective on the future evolution of the Infobahn. "The Electronic Superhighway Revolution, 1994-2010," provided by Strategic Futures Inc., was undertaken to determine how the superhighway will emerge over the next 15 years. The study team consisted of management consultants, market researchers, technologists and business executives who have experience in cable TV, telephony, computing, consumer electronics, and publishing, among others.

The study addresses the economics of the superhighway and attempts to determine what will be built, when, and by whom. Here are a few highlights:

✔ The superhighway infrastructure will cost about $300 billion between now and 2010, not including computers, video file servers and related software and hardware.

✔ The infrastructure, consisting primarily of hybrid fiber/coax topology until the year 2000 for economic reasons, will largely be built by the telcos, with cable operators a "distant second" in terms of miles of cable to be laid, followed by utilities, who'll enter the fray after 2000. Why? Because the telcos will have access to about $200 billion for infrastructure over the next 10 years, while MSOs will have just $40 billion to spend.

✔ After 2000, the topology of choice becomes fiber to the curb or fiber to the home.

✔ Market trials and new ideas will dominate the landscape through 1997, and it will be 2000 before the real winners emerge with products and services that dominate the market. Intelligent networks become pervasive in 2005 to help make qualitative changes in consumer lifestyles, a process that is largely completed by 2010.

✔ Video-on-demand isn't the "killer app." Economics dictate that service providers will have to charge $5 to $6.50 per movie and will have to enjoy "take rates" much higher than those found in most pay-per-view scenarios.

The bottom line? Payback periods are going to stretch beyond what is acceptable today. This is especially true when it comes to digital set-tops, which will be expensive. Content developers who stick it out for the long haul can expect big payoffs, but it's going to take investment and planning today.

The go-slow approach may fly in the face of the marketing executives who come forth and predict huge revolutions in television viewing, distance learning and exotic applications like telemedicine, home shopping, and the like. But network planners should get this point: plan now. Don't close any doors. For as the report notes, "If there is any single message to be learned, relative to the (superhighway), it is that, in most cases, doing it right will be more important than doing it first."

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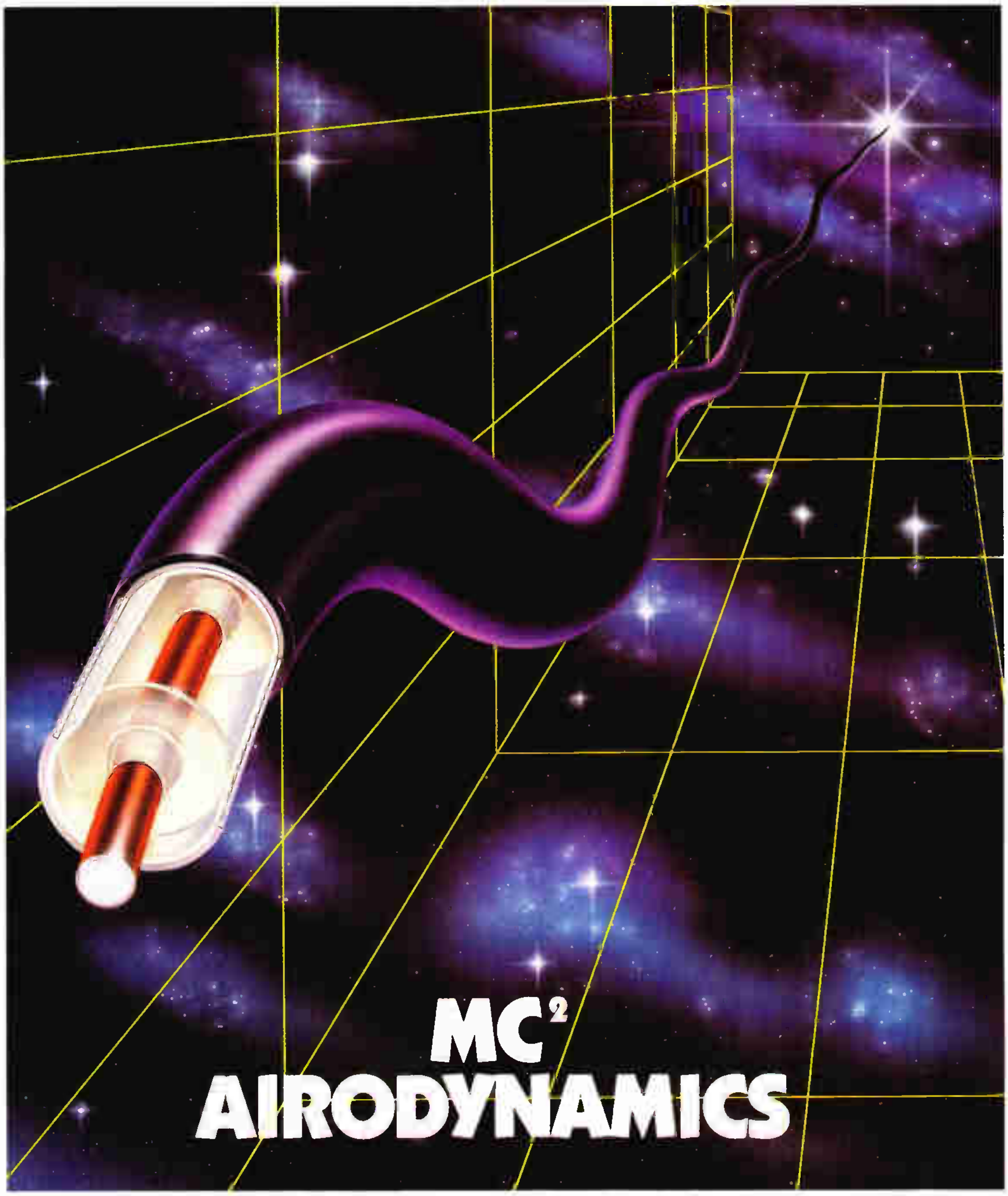

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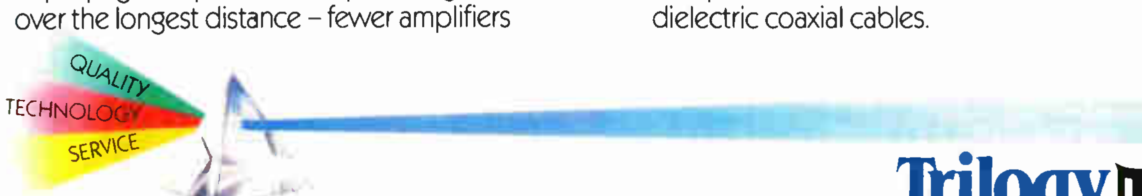

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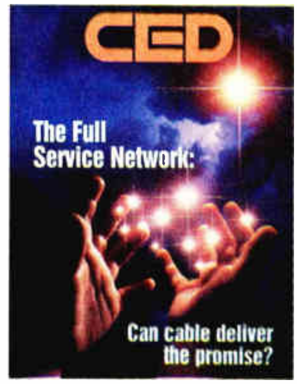

About the Cover

The promise of the advanced broadband network. Illustration by Steven Hunt, The Image Bank.

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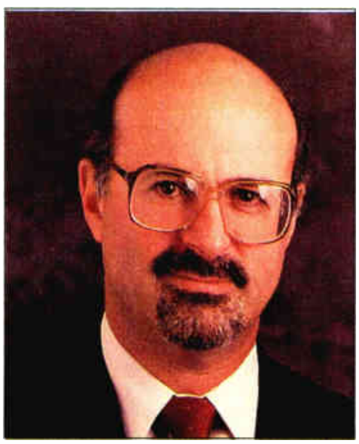
RBOCs are out of control



By Jeffrey Krauss, student of techno-politics and President of Telecommunications and Technology Policy

The RBOCs intend to enter the cable TV business, but new evidence confirms that the FCC is unable to control RBOC rates and bookkeeping. The FCC is only now catching up with illegal RBOC behavior that began in the late 1980s and apparently continues to the present. You can be sure that RBOCs will continue to play the same games–overcharging their monopoly customers in order to cross-subsidize their broadband services.

"Show cause" orders

A few years ago, the FCC staff noticed some unusual results in the price cap data for 1988. The FCC then ordered the seven Regional Bell Operating Companies to hire an independent audit firm to check the books. Ernst & Young (the company hired by the RBOCs) determined that the RBOCs were misstating and miscalculating costs and revenues. The result has been higher access charge costs imposed on long distance carriers, creating higher rates for long distance calling. The Ernst & Young findings are the basis for the FCC "show cause" orders issued against the RBOCs.

A show cause order is like an indictment in a criminal case. All the evidence has been collected, but you haven't been found guilty yet. Not quite, but pretty close. The RBOCs still have the opportunity to defend themselves. But the details disclosed in the FCC orders suggest that the RBOCs have intentionally and systematically misreported the financial and operations data used in the FCC's "price cap" rate regulation process.

The result is likely to be large fines, perhaps totaling more than $1 million, assessed against the RBOCs. The FCC is authorized to impose fines of up to $6,000 per day for accounting-related violations. The FCC has decided that these violations began January 1, 1988 and have gone on ever since. The Communications Act has a "statute of limitations" provision that limits the period to five years, but five years at $6,000 per day is more than $10 million. For an RBOC like Ameritech, which is made up of five operating common carriers, each carrier is subject to a separate, $10 million fine.

RBOC violations

The FCC reported that each of the RBOCs had numerous violations, and the types of violations differed from one RBOC to another. The overcharges listed below are for the period covered by the audit: January 1988 through March 1989. Because the violations have continued up to the present, the total amounts of overcharges are much higher. Here are some of the highlights.

✔ Bell Atlantic overstated its costs by $21 million by using an improper cost allocation procedure. Rate regulation requires that costs which are shared among different services be allocated to the services. In this case, costs which should have been allocated to intrastate services were improperly allocated to interstate services, raising the cost to interstate long distance customers.

✔ Nynex misallocated its rent. It assigned all rent revenues to intrastate services, but allocated associated rent expenses partly to interstate and partly to intrastate services. The result was an overcharge of $12 million to interstate services.

✔ Ameritech miscalculated its cash working capital. Cash working capital is the average amount of capital needed to finance day-to-day operations and is considered to be a part of a carrier's rate base. Average cash working capital is calculated using studies that measure cash inflows and outflows in relation to the time service is rendered ("lead-lag" studies). Ameritech improperly included equity in its lead-lag studies, not just expenses and revenues. The result was a $7.5 million overcharge during the 15 months of the audit period.

✔ Pacific Bell overcharged more than $6 million by assigning certain revenues to an account entitled "end user revenue," when those should have been assigned to the account "switched access revenue."

✔ FCC accounting rules require that unfunded pension costs be deducted from the rate base. US West did not do this, resulting in overcharges of $10 million.

✔ Both Southwestern Bell and BellSouth overstated a component of their cash working capital requirements by using average bank balances instead of the minimum balances that some banks require. Under FCC rules, minimum bank balances are rate base items because they are used to compensate banks for services provided to the account, in lieu of fees charged for the services. The amount of the resulting overcharge was nearly $5 million for BellSouth and $2 million for Southwestern Bell. Southwestern Bell was also caught with a $2.3 million overcharge because it used the wrong interest rate in another calculation.

It seems pretty clear that FCC rate regulation is severely deficient when it applies to the RBOCs. It took until 1995 for the FCC to determine that the RBOCs were violating accounting regulations in the 1988-89 time frame.

This has serious implications for allowing the RBOCs into cable TV and long distance services. If they can get away for years with misallocating the costs and revenues of local voice services, they can do the same for broadband and long distance services.

This all came up at a very embarrassing time for the RBOCs, in light of the legislation now pending. By the time you read this, the affected industries may have already reached agreement on compromises being negotiated. These FCC revelations of RBOC rule violations are likely to hurt the RBOCs in these crucial legislative negotiations. CED

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DBS market should get crowded as new entrants make launch plans

On the heels of DirecTv's wild success in direct broadcast satellite, new competitors are beginning to appear, and an old nemesis has announced plans to upgrade its system.

Joining EchoStar on the DBS launchpad is Tee-Comm Electronics, which announced it will fire up AlphaStar, a new, high-power digital DBS service. The company will offers its services over AT&T satellites and use TV/COM's digital compression scheme.

AlphaStar intends to debut December 1, the in-service date of AT&T's Telstar 402R satellite, which will be used along with the Telstar 5 bird to ultimately offer more than 200 channels of video services.

TV/COM was chosen because it has based its compression method on open standards, such as the European DVB system, which is fully MPEG-2 compliant. The same system has also been chosen by Expressvu, Canada's DBS provider, as well as by satellite distribution service companies in Australia, Africa, Asia, Europe and South America.

Tee-Comm will manufacture the digital set-tops, remote controls and 24-inch receiving dishes for the system. The company already manufactures the Star Trak line of C-band integrated receivers/decoders.

Through Expressvu, in which it is a part owner, Tee-Comm will also serve Canadian consumers with DBS services, as the company was named as the exclusive manufacturer of the 250,000 systems Expressvu plans to deploy, beginning September 1. The value of the deal with Expressvu is worth a reported $191 million.

Meanwhile, Primestar recently announced its plans to begin using a new, elliptically shaped receiving antenna, as it prepares to use high-power satellites to deliver its programming services in 1996.

According to Primestar executives, the new antenna will be manufactured by Channel Master of North Carolina, and has the ability to differentiate between its own satellite signals and those transmitted by adjacent satellites, much like round antennas do today. However, the elliptical shape allows the dish to be smaller. For example, the performance of an elliptical antenna measuring 30 inches high is comparable to a 39-inch round antenna.

In addition, Primestar has begun offering a new remote control to all new subscribers, in preparation for the launch of the service's interactive program guide. Primestar has used "store-and-forward" technology to allow impulse PPV purchases since it launched in 1990.

RBOCs invest in MMDS provider

After years of trying, "wireless cable" may finally be a competitor to its wireline cousin.

Bell Atlantic and Nynex signaled a desire to speed their entry into the video market by agreeing to jointly invest up to $100 million to acquire up to 45 percent of CAI Wireless Systems of Albany, N.Y., a provider of microwave delivered video services.

These MMDS (multichannel multipoint distribution service) networks today can transmit a maximum of 33 channels of video, based on 6-MHz slots that are assigned and licensed. However, as digital transmission and compression becomes available, the very same systems can be used to transmit more than 100 channels of video.

MMDS, or wireless cable operators, have been trying for years to effectively compete with hard-wired cable systems, but have been hampered by high programming prices and a lack of funding. The FCC in recent years opened more spectrum and prohibited cable operators from holding MMDS licenses in an effort to spur more competition.

MMDS, as a line-of-sight service, is expected to serve up to 75 percent of the homes with high-quality digital and audio service. That number is, of course, dependent on the topography of the region in which it is installed. Even with those caveats, officials from both RBOCs said MMDS service allows them to enter the video marketplace quickly with services that pull from the best of cable TV, DBS and other high-quality audio.

The investment in CAI is scheduled to occur in two stages. In the first stage, Nynex and Bell Atlantic will invest $15 million each, followed by another $35 million each later this year.

CAI already has access to spectrum in metropolitan New York City, Albany, Buffalo, Syracuse, Boston, Hartford, Providence, Rochester and Norfolk, Va. The company has announced plans to acquire licenses for spectrum in Pittsburgh; Philadelphia; Washington, D.C.; Baltimore; Cleveland and Stockton and Bakersfield, Calif. in a complicated arrangement of purchases and trades with ACS Enterprise Systems, Eastern Cable Networks, Peoples Choice Television and Partnership and American Wireless Systems. When the deals close, CAI will serve about 115,000 of a potential population of 20 million TV households.

Sprint/cable venture wins 29 PCS licenses

While the RBOCs are looking to offer video by acquiring MMDS licenses, the Sprint/cable TV venture plunked down $2.1 billion for rights to deliver personal communications services in 29 major trading areas in the United States, while committing to spend another $2.3 billion over the next few years to build the infrastructure.

The MSOs represented in the venture include TCI, Comcast and Cox Communications.

Licenses covering a population of 182 million people and eight of the top 10 markets were won by the consortium during the highly publicized 112-round auction hosted by the Federal Communications Commission last winter. The consortium, known as WirelessCo., spent an average of $14.56 per person, or about $1 less per person than the average for all auction bidders.

The venture's partners successfully overlayed wireless coverage in markets where the cable partners already have substantial coverage, said key officials associated with the venture. The cable partners already have nearly 290,000 cable miles in place, passing about one-third of the homes in the U.S. in 48 states and the top 50 markets. It is expected that the cable plant will be used as a key part of the network infrastructure. The venture could offer voice, video and data services when regulatory barriers are removed.

"When you look at a map and see our cable partners serving territory, and you overlay our new wireless presence, you can clearly see a new type of full-service, nationwide communications company emerging," said Gary Forsee, who oversaw the bidding process for the consortium.

Specifically, licenses were awarded for the following trading areas: New York City; San Francisco; Detroit; Dallas/Forth Worth; Boston; Minneapolis; Miami; New Orleans; St. Louis; Milwaukee; Pittsburgh; Denver; Seattle; Louisville; Phoenix; Birmingham, Ala.; Portland, Ore.; Indianapolis; Des Moines; San Antonio; Kansas City; Buffalo; Salt Lake City; Little Rock; Oklahoma City;

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Personal communications services (PCS) has been touted as a competitor to existing cellular service providers. PCS providers have promised to offer telephone service for less cost, using low-power handsets that feature longer battery life.

MPEG-2 market heats up at NAB

While cable operators are frustrated by the delayed introduction of digital set-tops, the fast-moving MPEG-2 market continues to heat up with new product announcements and news that an intellectual property rights group has reached agreement on royalty payments.

During last month's National Association of Broadcasters (NAB) confab in Las Vegas, several new encoders and servers made their debut, signaling the start of the MPEG-2 era. For example, announcements were made by Scientific-Atlanta, Micropolis, Compression Labs Inc., Hyundai, Optivision, C-Cube Microsystems and others.

Micropolis announced an MPEG-2 video server with a maximum data rate of 15 Mbps on a single channel. Each video decoder board utilizes C-Cube's CL-9100 decompression chips and provides up to four composite video channels at 6 Mbps. The server can host up to 16 boards, supporting a total of 64 channels.

Meanwhile, C-Cube debuted a new, low-cost MPEG-2 encoder for electronic newsgathering, distance learning, ad insertion and other cost sensitive applications. It runs on four C-Cube VideoRISC processors.

CLI announced its MPEG-2 compliant Magnitude family of digital products during NAB. The new Magnitude encoder includes statistical multiplexing, which dynamically allocates more bandwidth to channels that need it. For example, a live sporting event needs more bandwidth than a talk show.

Hyundai Digital Media division of Hyundai Electronics America announced a single-chip solution offering MPEG-2 video, audio and systems decoding. The devices are scheduled for production during the summer and will be shipped beginning in August. Hyundai has targeted set-top box makers and others as the primary consumers of the device.

Optivision previewed a four-channel MPEG-2 decoder for Silicon Graphics' Challenge media servers, while Scientific-Atlanta took the wraps off "PowerVu," its new MPEG-2 video compression system for DBS and programmers that includes a suite of encoders and decoders, multiplexers and modulators.

Finally, an international MPEG Intellectual Property Rights group meeting resulted in a fundamental agreement establishing a licensing group, according to Baryn Futa, COO of CableLabs and chairman of the group. During a meeting last March, the working group developed an initial royalty model for digital decoders, videodisk players and pre-recorded storage media, including CDs.

SCTE changes name, gets new members

The SCTE will officially become the "Society of Cable Telecommunications Engineers" next month when the board of directors meets just prior to the opening of the annual Cable-Tec Expo in Las Vegas.

The new name, which substitutes the word "telecommunications" for "television," reflects the evolutionary changes going on within the broadband industry, according to SCTE President Bill Riker. The name change was approved by 93 percent of the SCTE members who voted in the latest board elections.

The election will result in some new faces at SCTE board meetings as well. Two at-large positions and five regional directors were up for election to two-year terms, commencing in June.

Wendell Bailey of NCTA and Wendell Woody of Sprint/North Supply both won re-election as at-large members. They defeated William Karnes of ISC Datacom and Don Shackelford of Time Warner Cable in Memphis for those positions.

In Region 1, which serves California, Hawaii and Nevada, Patrick O'Hare of Viacom Cable defeated Kathleen Horst of Main Line Equipment to win a seat on the board. In Region 2, which represents Arizona, Colorado, New Mexico, Utah and Wyoming, Steve Johnson of Time Warner Cable defeated Ron Hranac of Coaxial International.

Incumbent Robert Schaeffer, vice president of engineering at Star Cablevision Group, will continue to represent the states of Minnesota, North and South Dakota and Wisconsin. He defeated a former board member, Rich Henkemeyer of ADC Telecommunications, to rejoin the group.

Likewise, incumbent Hugh McCarley of Cox Communications won re-election as Region 9 director, representing Florida, Georgia, South Carolina and the Caribbean. He defeated David Spallinger of Continental Cablevision.

And finally, Dennis Quinter of Time Warner Cable in Reading, Pa. unseated incumbent Bernie Czarnecki of Cablemasters Corp. and beat out a bid by Gene Coll of Diamond Communication Products to become the new Region 11 director, representing Delaware, Maryland, New Jersey and Pennsylvania.

These directors will join Tom Elliot of TCI, Andy Scott of Columbia Cable, Rosa Rosas of Moffat Communications, Larry Stiffelman and Steve Christopher of CommScope, Terry Bush of Trilithic, Mike Smith of Adelphia and John Vartanian of Viewer's Choice at the June 13 board meeting, where officers will be elected.

Jottings

Reliance Comm/Tec and **Philips Broadband Networks** will jointly develop and market a telephony-over-cable system that is based on Philips' Gateway and Reliance's Matrix interactive system. Meanwhile, Philips has announced NewChannels will be field testing the Philips Communications Gateway in its Syracuse, N.Y. system in a four-phase program. NewChannels is already testing a cablephone system developed by Tellabs . . . Preliminary results of a new study by **Bellcore** show that LMDS and FSS services can share the 27.5 GHz to 29.5 GHz spectrum. The findings should help clear the way for LMDS providers to get licenses to compete against cable TV operators. Needless to say, those operators are cheering the news . . . **Zenith** has decided to make a VSB modulation test system available for sale to allow companies to verify test results in their own labs. The test kit includes a transmitter, receiver and PC interface software. It operates in 16-, 8-, 4- and 2-VSB modes and transmits up to 43 Mbps in 6 MHz . . . **BellSouth** has chosen **Northern Telecom** to build a $100 million GSM-based personal communications network for the Carolinas and East Tennessee. Construction should take about three years . . . By the way, Northern Telecom unveiled a new logo and moniker: the company is now known as "Nortel". . . **Arrowsmith Technologies'** Fleetcon workforce management software will be integrated into the new TCI "Summit" subscriber management system as the foundation for the dispatch function. Arrowsmith will work with TCI and Sybase to develop the system . . . **ADC Telecommunications** completed its acquisition of AOFR, a manufacturer of fiber optic couplers and components. The AOFR line will be added to ADC's line of fiber distribution frame and outside plant products . . . . CED

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The devil and Steve Pearse

Steve Pearse

He knows where the phone companies hurt. It's somewhere in the region of their software. But instead of bandaging up his old telco wounds, he is ready to start fresh to avoid their mistakes. Best of all, he has come over to the 'other side'–cable TV. In his new role as Time Warner Communications' senior vice president of engineering and operations, Steve Pearse is ready to make the company's telephony services unit into a worthy rival for the telcos' customers.

Pearse brings knowledge of the inner workings of AT&T, Bell Labs and Sprint to his new job, a knowledge which makes him very appreciative of his latest opportunity with Time Warner.

"The ability to create a platform for a brand-new telephone company, without any legacy, is golden," he enthuses. Pearse should know: he spent much of his time with the telcos killing himself re-engineering their systems. "A typical RBOC will spend $600 million a year on software," he explains. "And most of that is spent in hammers, trying to beat the devil out of the code, to make it do things that it just doesn't want to do."

Pearse began his telecommunications odyssey with AT&T, which recruited him fresh out of MIT's Sloan Business School for a fast-track management development program. From AT&T, he moved on to Bell Laboratories, where he obtained his master's degree in electrical engineering, and worked on Signaling System 7 and ISDN. From there, he was promoted to software development–the youngest district manager ever to work in that arena for the lab. But he had a yen to be a part of the next wave in telecommunications–long distance competition–so he let Sprint lure him away to engineer a turnaround for its own software development organization. Eventually, he was promoted to vice president of operations with the long distance carrier, then vice president of engineering and planning. Growing restless once more, Pearse realized it was time to jump into the second wave: local telephony competition, and a position with Time Warner.

One company, one database

After nightmarish years of dealing with monstrous, untouchable telco computer codes, Pearse's long-time dream was to create a new telecommunications software platform. And what better place to do that than in a fledgling telephone company that is an offshoot of an entrepreneurial MSO?

Pearse exudes a religious fervor about his quest to create one computing platform for all of the company's operations, and to realize that mission, he has been given control of four groups: national operations, engineering, ISS (or Information Support Systems) and planning. Time Warner is employing squads of software engineers to work, under Pearse's direction, to create a platform that is based on a Sybase software engine, and which runs on UNIX.

What Pearse is striving for is, in theory, simple: That one phone call from a customer will handle all of his/her needs, whether they be ordering service, handling a billing dispute, or signing up for a discount on HBO, bundled with local telephone service. And this will all be done in real-time, not to mention the fact that Time Warner, unlike any of the telcos, will be able to introduce a brand-new product in a single day.

Not only that, but the entire telecom platform will be implemented for a cost that is two orders of magnitude less than what an RBOC must pay simply to maintain its system from year to year, he notes.

Pearse thinks the industry has a good handle on all the issues involved in offering telephony, except one: the ability of the RBOCs to cause problems in Washington. Specifically, he fears that the current Pressler bill in the Senate will not go far enough in restraining the RBOCs, but will merely slap penalties on operators who do not negotiate in good faith.

"If I were an RBOC," notes Pearse, "I'd pay a million bucks a day in penalties if I didn't have to give my competition number portability." Another issue that worries him is the ability of the telephone companies to guess what cable's profit margin for telephony would be, and then charge exactly that margin for interconnection services. That would effectively kill any possibility of local exchange competition. And the only way to avoid that unpleasant outcome, notes Pearse, is to make sure that the telcos are regulated "asymmetrically" until a truly competitive environment can be established.

The next wave

So what would you expect a software junkie like Pearse to do in his spare time? Tinker with his home computer, of course, until his wife finds a covert way to destroy it. He also plays racquetball and hits the Stairmaster to preserve his sanity, and is busily adding to his collection of "American lore": microbrewery bottles with labels like "Flying Dog Beer," "Buffalo White Peace Ale" and "Rattlesnake." Or, you might find him listening to his favorite "head music"–everything from Brian Eno to Kate Bush, David Bowie, Genesis and Laurie Anderson–over the cries of protest from his three children, ages 7, 9 and 11.

You might even find him contemplating the next wave of telecommunications competition: a broad array of Full Service Network offerings which will run on the transactional platform that he is creating.

For those RBOCs who are downplaying cable's ability to enter telephony, Pearse has just three, deadly-quiet words: "You are misinformed." CED

–Dana Cervenka

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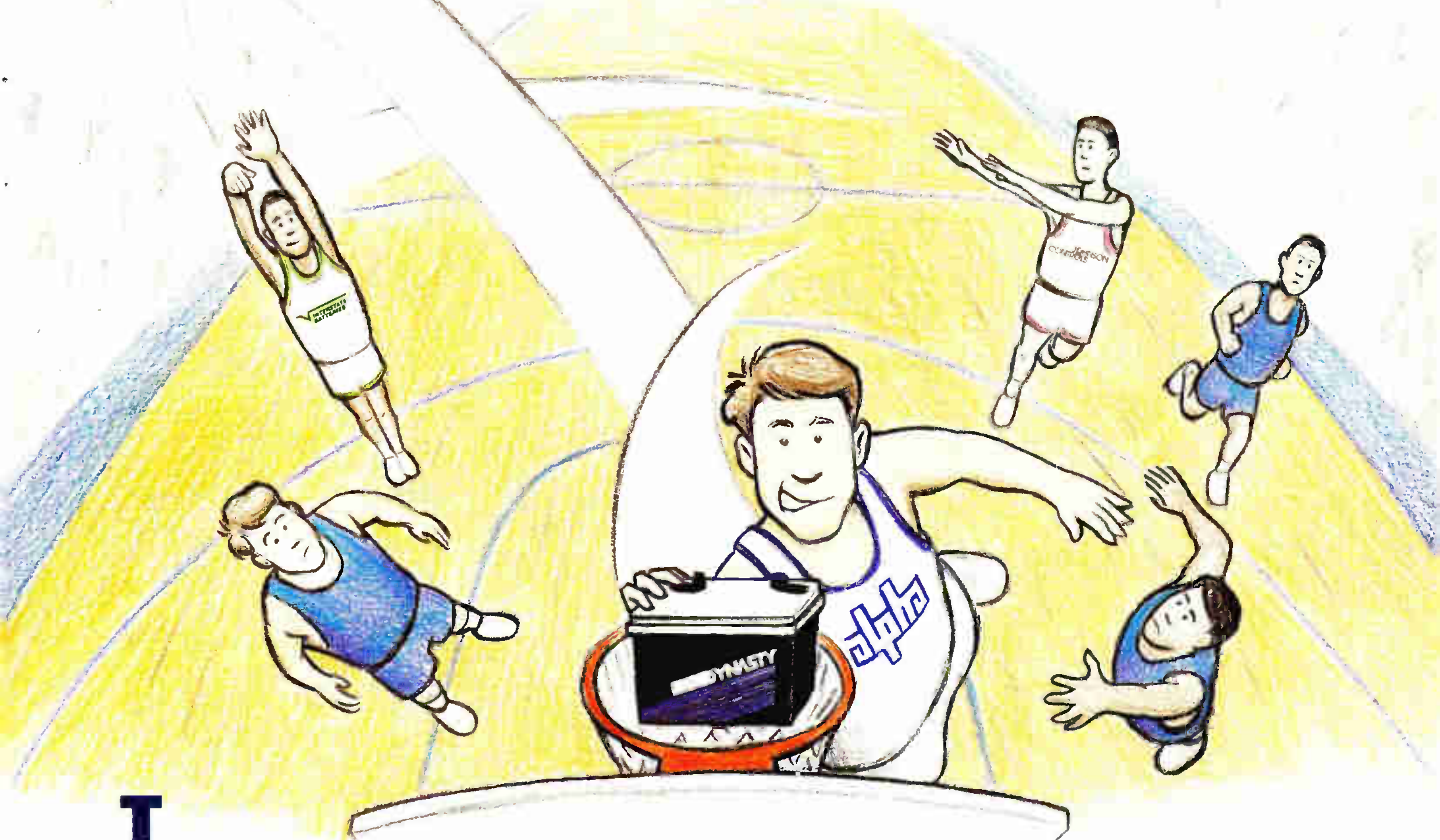

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Disabled must have easy NII access

By Wendell Bailey, VP of Science and Technology, NCTA

In my position at NCTA, I have frequently been approached by different groups to participate in advisory boards on various issues. A lot of times, these are committees related to government activities, examples of which would be the FCC's Advisory Committee on Advanced Television Service and the FCC's Network Reliability Council. But frequently, there are projects that are not direct activities of the government, but which nonetheless, have connections to the U.S. government.

Several years ago, one committee that I served on related to the issue of closed captioning for the hearing impaired. Before all television sets above 13 inches of diagonal measurement were required to have circuitry to decode captioning information, people used closed captioning adapters. These adapters were sold to the public at a price that included a subsidy provided for by the government. You may have noticed, if you had a reason to notice, that all of these adapters came from one or two manufacturers. The reason? Because the groups applying for the product subsidies had to submit information about how they were going to build the adapter, what its features were, what its potential cost was, and what part the subsidy would play in it. The same company won the subsidy agreement from the government on each of the cycles that I worked as a committee member, and thus, the adapters were frequently made by the same companies that had partnered with the bidder.

In December of last year, I was approached by an old friend at the World Institute on Disability to work on a project regarding universal access. While at first I was reluctant to get involved in another advisory group, several things about this group appealed to me. First, the idea was explained to me by someone who I respect, and who has done a lot to bring the issue of access for disabled people to the forefront of many debates in America, as well as around the world. Secondly, this project proceeded from an interesting perspective: access for people with disabilities to the National Information Infrastructure, or the information superhighway.

In previous articles, I have mentioned the difficulty I think that we and other service providers will have with some segments of our population when the superhighway is completed, because a large part of the access to information databases is achieved through computer keyboards. People who are functionally illiterate will have a difficult time having full access with full utility when they have to depend on a keyboard-based system. While this idea had been on my mind for some time, I had not previously thought about people with perfectly good minds, perfectly good ideas, education and training, and most importantly, with desire being faced with the problem of access to information when it comes in forms that are fundamentally at odds with their particular disability.

For example, a computer-based screen that has been converted to Windows is very good for someone who cannot type but who can move a mouse around, but what good are icons, charts and graphs to someone who is visually impaired or blind? There does exist software that allows the mouse pointer to announce an icon when the cursor is moving across it. But what good is that to a person who is also deaf? And lest you think that this would be an unusual circumstance, believe me, it's not as unusual as you think. What about access to something as prosaic as a mouse for someone who has motor disabilities, or the inability to move at all?

Designing to anticipate difficulties

As the computer age has dawned, a lot of software writers and other people interested in access to information by the disabled have developed truly creative software to allow many of the disabled to use computers in the same way that anyone else uses them. One is tempted to ask: Why do we need a committee or a project to look into ways for people with disabilities to access the National Information Infrastructure if a lot of this has already been taken care of?

The primary reason that we are forming a project for this purpose is that it would be nice, for a change, to think out the problems in advance, project the conflicts of the future on to the screen, and discuss ways to circumvent access problems. We need to find out *now* what might be a problem, before hardware or software is committed to a form that is hard or impossible to modify, and yet is less appropriate for people with disabilities than for people with normal capability.

Many products are designed and sold on the market, and then changes occur over and over again as the people who manufacture such devices find things that consumers want or need to make the product more useful or friendly. Even regular products could benefit from a careful analysis or serious discussion of how customers would use a device, and what is needed for that device to be useful to all possible customers before products are manufactured. The idea of The World Institute on Disability to undertake such a project for people with disabilities is exciting and makes perfectly good sense to me.

For the National Information Infrastructure to be useful to the largest number of people, access to it needs to be easy and assured for everyone. Anyone with a desire and an ability to use information should be able to access the superhighway of the future with whatever tools and techniques that they have to use. Work and study on the issue *now* will help make that goal possible in the future. CED


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The complexity of simple coax

By Chris Bowick, Group Vice President/Technology, Jones Intercable

The characteristic impedance of a transmission line, such as a coaxial cable, is an often misunderstood topic. People who deal with DC circuits on a daily basis are accustomed to using interconnecting wires that are "ideal" and have no (or negligible) resistance or inductive or capacitive reactance. In the radio frequency (RF) world, however, we can no longer think of interconnecting wire as "ideal," but must understand and be capable of modeling its RF properties over a wide range of frequencies. Coaxial cable, as simple as it looks, is a complex, electrical circuit consisting of resistance, as well as inductive and capacitive reactance to an RF signal.

Characteristic impedance is defined as "that value of impedance, measured at the input end of the line, when the other end is terminated in an impedance of like value."[1] Because a piece of coax is, generally speaking, electrically long when compared to the wavelength of the RF signal it is carrying, you might expect it to have some inductance in addition to the resistance distributed in series along its length. Such inductance (L) translates into some amount of equivalent inductive reactance (X_L) that is dependent upon the frequency (f) of operation and is based on the formula $X_L = 2\pi fL$. Inductive reactance, as the formula implies, is an opposition to the flow of electric current and increases linearly with frequency. In other words, as the frequency of operation increases, the inductive reactance, and hence the opposition to the flow of electric current, increases. Therefore, at very high frequencies, even very small amounts of inductance will create very large amounts of inductive reactance.

Similarly, since coaxial cable consists of two conductors (inner and outer) separated by some form of dielectric material such as air or foam, you might also expect that electrically, the cable would have some amount of capacitance distributed in parallel throughout its length. This capacitance (C), creates an amount of capacitive reactance (X_C) that is dependent upon frequency (f) and can be found with the formula $X_C = 1/2\pi fC$. As the formula indicates, capacitive reactance varies inversely with frequency. Therefore, as the frequency of operation increases, capacitive reactance, or the opposition to the flow of electric current, decreases. It is this mix of distributed inductance and capacitance that defines the characteristic impedance of the coaxial cable, and these values are determined primarily by the construction and physical dimensions of the cable.

Since the inductance and capacitance of a length of coax are dependent upon its physical construction and dimensions, they are generally given in units per foot. The unit of inductance is the Henry, and the unit of capacitance is the Farad, so you might see specifications given as henries or microhenries per foot and farads, or microfarads per foot, respectively. The characteristic impedance (Z_0) of a piece of coax depends only on these values of inductance and capacitance and can be calculated by the equation $Z_0 = \sqrt{L/C}$. The characteristic impedance of coax, then, is that impedance that we would actually measure at its input (or anywhere along its length) if the coax were infinitely long! When a signal is "launched" into a piece of coax at the transmitting end, and while it is in "transit" to the other end, the signal's energy must charge the distributed capacitance within the coax, and likewise, it must induce an electric field throughout the distributed inductance along the entire length of the cable. While the signal is in transit down the length of coax, and before it reaches the other end, the only impedance it "sees" is the constant impedance which has been created by the uniform inductive and capacitive reactance per unit length of the coax. If the coax were infinitely long, this is the only impedance that the signal would ever see as it traveled along the cable to infinity.

In the real world

Practically speaking, however, our coaxial cable must terminate somewhere. Our job, then, is to have it terminate into a "load" that is exactly the same as the characteristic impedance of the coax, so that the coax "looks like" it's infinitely long to the signal. If we terminate the coax with an impedance that is equal to the characteristic impedance of the coax (defined by L and C), then the signal, not knowing the difference, will simply believe it is continuing to travel to infinity and will transfer all of its power into the terminating load. If, on the other hand, a terminating load is placed at the end of the coax that does not match the characteristic impedance of the coax, the signal will then see a "barrier" whose size is dependent upon the degree of impedance mismatch, and some amount of the signal will be reflected off of the barrier back toward the source; therefore, not all of the signal's energy will be transferred to the load.

The definition of characteristic impedance that was given at the beginning of the second paragraph should now be a little more clear. If, for example, we were to measure the input impedance of a piece of coax that has been terminated with a load that matches the characteristic impedance of the coax, then the value of impedance that we would measure would be equivalent to the characteristic impedance of the coax. If, on the other hand, we were to terminate the coax at the other end with some other value of load impedance, then the impedance we would measure at the input of the coax would not be the same as the characteristic impedance of the coax. Instead, it could be just about any other value, depending upon the electrical length of the coax and the operating frequency. For this reason, in broadband networks, it's imperative that source and load impedances be matched to the characteristic impedance of the coaxial cable being used. CED

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Sizzle and spark: HFC power safety

By Tom Osterman, President, Comm/net Systems Inc.

As a power conversion design consultant, I have been involved recently in discussions with both cable TV and telecommunications design engineers about system powering approaches. These discussions have also included manufacturers of power supply equipment and suppliers of amplifiers and passives, as well as telecom equipment.

Higher powering voltages

Cable television providers that are implementing telephony and other services on their existing networks are looking for a reasonable "upgrade" path. This path includes higher voltage approaches that provide the additional powering capacity required by telephony service.

Recently, Time Warner deployed power supplies with a 90 VAC, 60 Hz output in system trials. Other operators are either testing 90 volts, or are considering doing so. What is attractive about higher voltage power systems is the extended "powering reach" and capacity of the power source to operate new telephony devices in the distribution network.

Telephony providers are approaching the powering issue from a different perspective that includes existing reliability requirements for the telephone systems, which are currently powered with -48 VDC. Hybrid fiber/coax telephony network designers are quickly becoming familiar with the unique characteristics of coaxial cable as a power conductor–particularly the issues of limited current-carrying capacity, corrosion susceptibility and utility neutral return current interaction.

Current telephone HFC network trials include use of the following options: 60 VAC, 60 Hz; 90 VAC, 60 Hz; and 90V, 1 Hz. "Telecom grade" power sources provide a minimum of eight hours of back-up time, redundancy and network monitoring. Power supply manufacturers have responded to these requirements by designing "power nodes."

Centralized powering

A power node provides a high power output (up to 7 Kilowatts) in a single location to feed all of the actives, including telephone network interface devices, in a 500-home node area. The power node typically includes a battery system and a self-contained generator for long back-up time. These systems are significantly more powerful and expensive than existing cable TV power systems.

Telecom providers have embraced the "centralized" powering concept as the preferred method to power HFC broadband telephony with the reliability required to carry lifeline telephone service. There are, however, two troublesome issues surrounding these new powering systems: voltage and current.

Manufacturers of amplifiers and passive devices have been required to update their products for both increased voltage operational capability, as well as higher "through-current" passing capability. To power the typical broadband devices and the added telephony requirements, higher powered systems are being used.

This increase in powering is having an impact on the reliability and operator safety of active and passive devices. There is significant concern about what happens to the internal connections, circuitry and to the contact point where a short circuit occurs. In addition, a much higher amount of energy can be delivered into a fault location than could be delivered in existing cable TV systems.

Power-passing taps

Further to the point is the development of the power-passing tap. This device is required by those MSOs that will deploy a side-of-home network interface device which receives power from the network. Can you imagine what could happen if a subscriber's dog chews on a drop cable with 90 volts present and several kilowatts of discharge capability?

The National Electrical Code (NEC) requires a power limit of no more than 100 Volt Amps (Watts) into a short circuit on the drop. The power-passing taps currently being designed include a current limiting circuit that provides compliance with the NEC, albeit at a much higher cost and complexity than existing taps. This power output is available via either a separate copper twisted pair drop, or through a combined RF/power coax drop.

Safety

A prime consideration of network and equipment designers is the safety of these higher-power systems. In my opinion, this area is an opportunity for the SCTE, NCTA and CableLabs to encourage a more formal industry discussion of these points. The objective is to quickly provide preliminary safety standards in order to guide the development of the new, higher-power networks.

Suggested safety features might include the following items:

✔ Shielding from high voltage access points.
✔ "Smart" circuit breakers in power sources and amplifier output ports.
✔ Visual indicators of high voltage present.
✔ Current limiting power-passing taps with reduced access to voltage internally.
✔ Restricted drop connector access at the home to reduce shock hazard.
✔ Consideration of lower voltages from the tap output to the home (such as 30-60V).
✔ Programs for field technicians and installers to reduce shock hazard potential. CED

Return path a fantastic voyage?

Just how hostile is it?

Engineers commissioned by CableLabs took to the field last year in search of hard data about cable's return path.

The team's report, to be published before the month is out, identifies three areas where cable operators face challenges–each of which can be overcome. These areas are misaligned amplifiers, recurring narrowband noise and broadband, short-duration bursts of noise.

Amidst these obstacles, successful upstream digital signaling–a necessity if cable is to build broadband, interactive networks–"is a tough order, but achievable," says Dr. Richard Prodan, CableLabs' vice president of engineering. Prodan oversaw the study under the direction of the Network Integrity Working Group, chaired by Paul Schauer of Jones Intercable. The Working Group is part of the Telecommunications Subcommittee of the CableLabs Technical Advisory Committee.

In an interview, Prodan surveyed the 100-page report's findings and said tightened engineering practices will be essential–but they'll only solve part of the problem. In his opinion, "firewalls" will probably have to be built separating impairment-riddled drop and in-home environments from clean, manageable fiber backbones and headends.

The study

The study, entitled "Two-Way Cable Television System Characterization," was conducted by CableLabs' engineering department, which Prodan heads. Contractors included AT&T, which provided engineering design; Rogers Engineering, which managed test equipment in the field and wrote data-gathering software; and GT Communications, which did the actual data acquisition.

The targets were five cable systems, the identities of which were not revealed, that have functioning two-way plant. All five used the industry-standard 5-30 MHz subsplit upstream frequency allocation.

The researchers tested upstream and downstream transmission between headends and homes non-stop for 30 days, using QPSK modems to measure data transmission errors at T-1 (1.544 Mbps) rates.

As performance benchmarks, the study used the CCITT's G.821 Recommended Error Performance Objectives, which set standards for bit errors and other criteria at three levels of a digital network–local, medium and "high-grade performance."

The local-level benchmark is G.821's suggested minimum requirement for local exchange carrier (LEC) access lines; the medium and high grades are criteria for connections between LECs and interexchange carriers (IXCs), and for inter-IXC connection, respectively. These criteria are defined in terms of "errored seconds," "severely errored seconds" and "degraded minutes."

The criteria require that, in the local plant, 1.2 percent or fewer seconds contain bit errors, that 0.015 percent of those seconds be "severely errored," as defined in the table, and that less than 1.5 percent of the minutes be "degraded."

The methodology involved three steps:

✔ gathering baseline measurements, presented in one section of the report;
✔ identifying and remedying suspected causes of problems; and
✔ conducting another round of measurements, reported separately.

The findings

None of the five plants met the G.821 criterion initially, says Prodan. "You would have had to close your eyes during bad events to make the spec," he adds. "None were all that good."

But these results, he stressed, cannot be projected to all of the possible types of upstream transport. They refer only

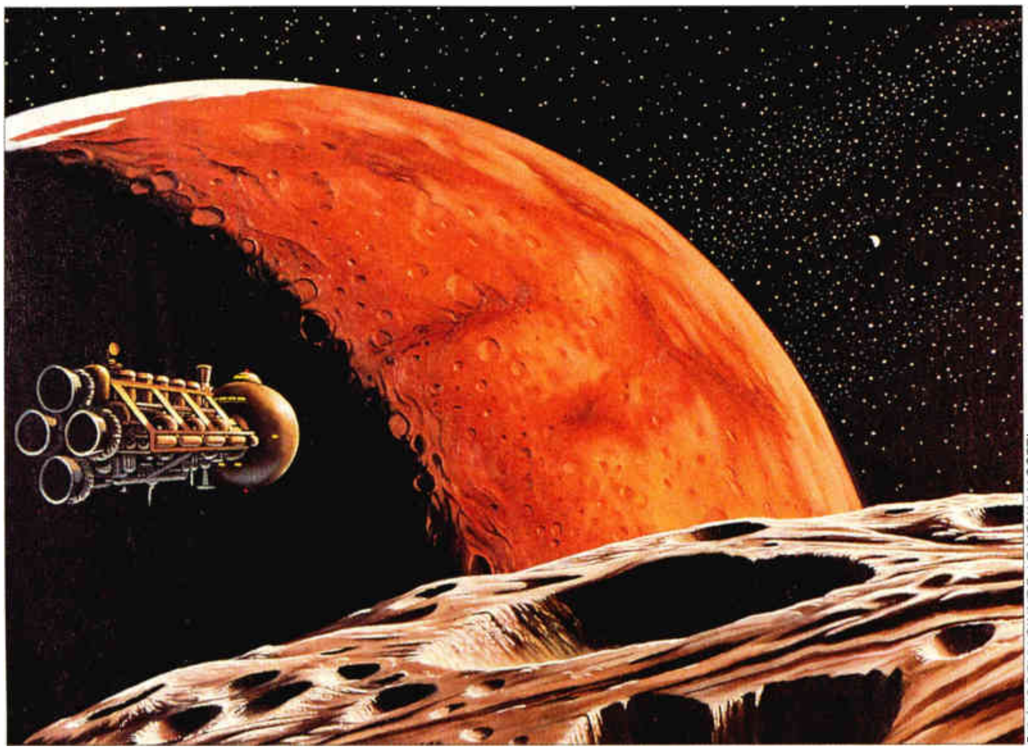
ILLUSTRATION BY DENNIS ARBOUR, SIS

to "a static QPSK T-1 carrier at a fixed frequency and level over an extended period of time." Further, the tests were conducted on a typical cable "bus" structure, meaning that traffic from thousands of homes was converging on a headend.

With this architecture as a given, "the level was initially set quite high to try to bang the data through at a level about 12 dB above the noise floor of the system," says Prodan. "In some cases, this caused a lot of distortion."

Still, the results pinpointed two factors influencing the bit errors: alignment and hardness. Alignment of amplifiers in a cascade seeks to maintain a unity gain in both directions throughout the plant. Overly weak signals can cause clipping, while overly strong ones can cause compression, often manifested as interference at five or more harmonic frequencies. "It's like playing your stereo too loud for your speakers," says Prodan. These problems were intermittent, occurring most frequently when systems were polling homes for PPV data. Alignment is achieved by power-adjusting individual set-top boxes and setting amplifiers to proper gain levels, according to Prodan.

Hardness refers to shielding plant properly so no energy can leak in from the outside. In the test, drop wires from taps into homes acted as antennas soaking up outside-the-home interference, while inside wiring picked up noise from things like hair dryers, blenders and radio-controlled toys.

Leakage also entered systems through poor connectors, improperly crimped shielding and weathered sheaths. These problems were eased by sweeping the plants for narrowband RF ingress and choosing "clean" carrier frequencies. But bursts of brief, broadband impulse noise proved harder to defend against. For example, environmental changes caused arcing of AC power supplies in the plant, interfering intermittently across much of the 5-30 MHz spectrum.

Another big factor was common-path distortion, caused by corroded or loose connectors acting like rectifiers or diodes, sending energy bouncing from the forward plant into the reverse plant.

Solutions? "Maintaining a hard plant is the only answer here," says Prodan. As a stopgap, high-pass filters, screening out 5-30 MHz signals, can be installed on all homes except those doing upstream signaling. But as two-way penetration grows, this "interim band-aid" no longer works, he notes.

To combat impulse noise, the report's authors recommend "temporal dispersion (e.g. interleaving) over a period longer than the impulse duration." In a more general vein, the report's authors note: "Meticulous

Bursts of brief, broadband impulse noise proved harder to defend against

In the uncontrolled section outside the firewall, reliable communication will be maintained by constraining capacity

plant hardening and precise gain alignment efforts are required to obtain any semblance of long-term reverse transmission reliability–there are no short cuts."

Prodan observes: "Obviously two things will have to happen. The transmission equipment will have to have some robustness in the face of some of these impairments that occur for brief periods of time over a wide range of frequencies. And the plant itself will have to be very highly maintained in terms of alignment and hardness."

Broader strategy

An overall mitigation strategy goes back to equipment design and network architecture issues, says Prodan, and includes such factors as error correction, interleaving and concealment. For example, a modem maker could design around energy leakages at short-wave frequencies, and around harmonics and intermodulation products across the spectrum. Static quadrature phase shift keying (QPSK) is only one approach; other modem techniques–spread spectrum, frequency agility, orthogonal frequency division multiplexing (OFDM) and diversity transmission–might be employed, he adds.

Prodan and his colleagues are discussing solutions not mentioned in the report. "We're thinking of other options that would require segmentation and gateways and other things," he explains. Segmenting means cutting off noise before it can funnel upstream toward the headend. "If you segment the plant into fewer subscribers in each signal path, you can hopefully get better performance," he notes.

Each of those segments, he adds, "has a gateway or firewall or demarcation point that is under strict control of the operator. From that point on, you have a clean signal back to the headend. You've got to stop the subscriber-generated impairments somewhere–you've got to plug the dike." Prodan adds that in this way, the remaining problems–the ones requiring truck rolls–may be contained to small groups of subscribers.

In the relatively uncontrolled section outside the firewall, reliable communication will be maintained by constraining capacity and using sub-Nyquist signaling, which means slowing down data rates: "That's how the deep space probes work," Prodan explains. "As they go farther from the Earth, they start talking very slowly. We may have to do similar things here: you aggregate fewer customers, and the modem has to talk slowly–fewer bits per second per Hertz." CED

This article was written especially for Cable Television Laboratories Inc.

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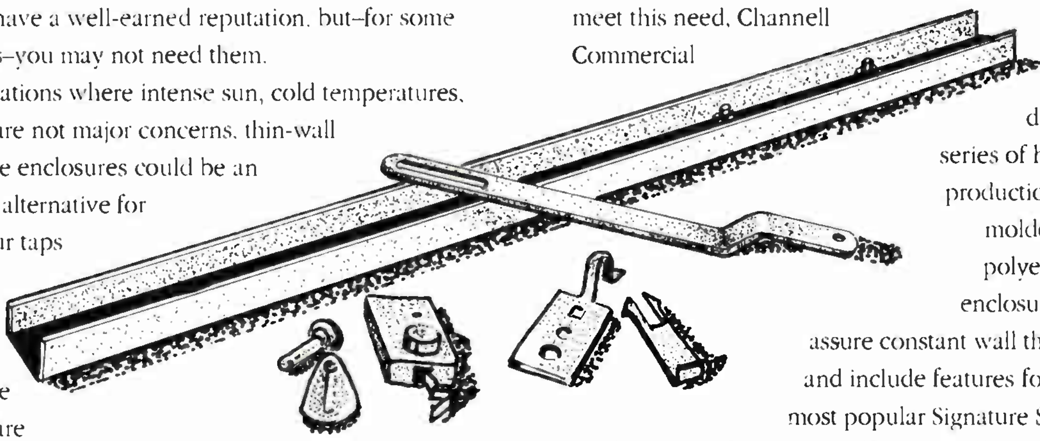

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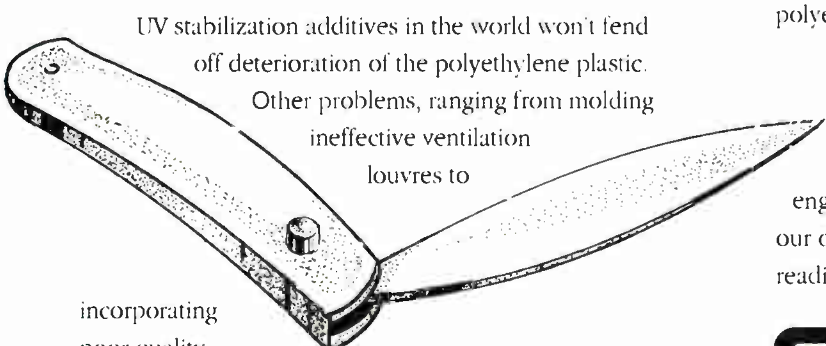

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Continued broadband evolution

ILLUSTRATION BY MICHAEL McGURL, SIS

By Andrew Paff, Executive Vice President, Strategic Planning and Technology, Antec Corp.

The evolution of the cable television network from an isolated, non-essential video broadcast medium to a high-speed, interactive and critical element of the global communications network began only a few years ago. Fiber optic technology eliminated the distance, performance and reliability limitations of the all-coaxial cable plant and put in place an infrastructure capable of providing services that step beyond traditional entertainment video.

The "promise" of the new telecommunications frontier created unprecedented interest in the financial markets, by regulators and among cross industry telecommunications concerns. What has occurred since can be described as "peeling the onion" on a complex array of technical and business issues. To date, the evolutionary path of the hybrid fiber/coax cable (HFC) infrastructure has yielded important and positive results, but has also created a great number of systems integration issues.

Identifying the technical issues

The basic hybrid fiber optic/coaxial cable architecture began to take shape with the early introduction of fiber optic technology into the cable television network. The core entertainment video broadcast business justified the fiber "star," coaxial "bus" topology which reduced the number of homes served by the coaxial bus.

In a process referred to in Figure 1 as "fiber as far as you can afford," cable operators began to look seriously at reliability, future applications and performance in the network design stage. Most operators equated the delivery of future interactive applications with increasingly critical bandwidth management needs. Node sizing and the continued migration path became increasingly important in broadband design. This part of the "onion" is easily peeled back and develops logically from the core business requirements.

As operators look to the future and prepare the HFC network to provide for the physical transport of interactive broadband applications, traditional cable television hardware is more likely to be modified than newly invented. New power supplies delivering greater powering flexibility, redundant optical receivers to improve system reliability, lower powered lasers to deliver node-specific services, and modular, easily upgraded analog/digital headend equipment are examples of this evolutionary process and are primarily extensions of

technologies that already exist.

HFC network management may indeed represent important new product innovation since little in the current stand-alone "status monitoring" domain will have applicability when the HFC network becomes just one element in an integrated, global structure. Network management will become fundamental to the business and will also define the scope of existing and new opportunity.

The development of an integrated and scalable network management solution will provide operators with the means to manage everything from service provisioning and performance monitoring to billing, fleet management and overall network control.

Identifying the applications

If applications will drive the continued HFC network evolution, then what are those applications? Anticipated opportunities include telecommuting, interactive games, video-on-demand and catalogue shopping, as well as residential telephony and personal communications services (PCS). Many of these, such as video-on-demand and games, will begin as broadcast, rather than interactive applications.

The question of which service will be the early winner with consumers is crucial only if the network will be designed to deliver that specific service through a specific subsystem. If a cable operator deploys a cable telephony network, a high-speed data network and a PCS network as three separate platforms, the risks will be great. The early interactive applications in particular will require the largest incremental investment and are subject to the most turbulent political and marketplace conditions. Network capital and operating costs, too, will be much higher with discrete networks. Efficient management of the precious broadband spectrum, particularly the upstream path, will be compromised if multiple networks need to managed. The risks are also evident for the hardware manufacturers which must develop cost-effective product based on anticipated high volume for a single "killer" application.

The question of which service is offered initially is, however, less important if the network is designed to provide a variety of distinct applications through a common platform. Integration of high-speed data, telephony and PCS is possible, even likely, in the evolving HFC network where common spectrum, transport format, network element management and headend processing functions can exist.

Platforms will differ. Broadcast NTSC video, the industry's current application, belongs in a single platform due to its delivery format. Broadcast digital video may represent another separate platform with the native MPEG-2 transport standard. Interactive applications involving voice and data communications may become a common platform as well, although this looks more difficult initially in light of the pace and competition in these areas.

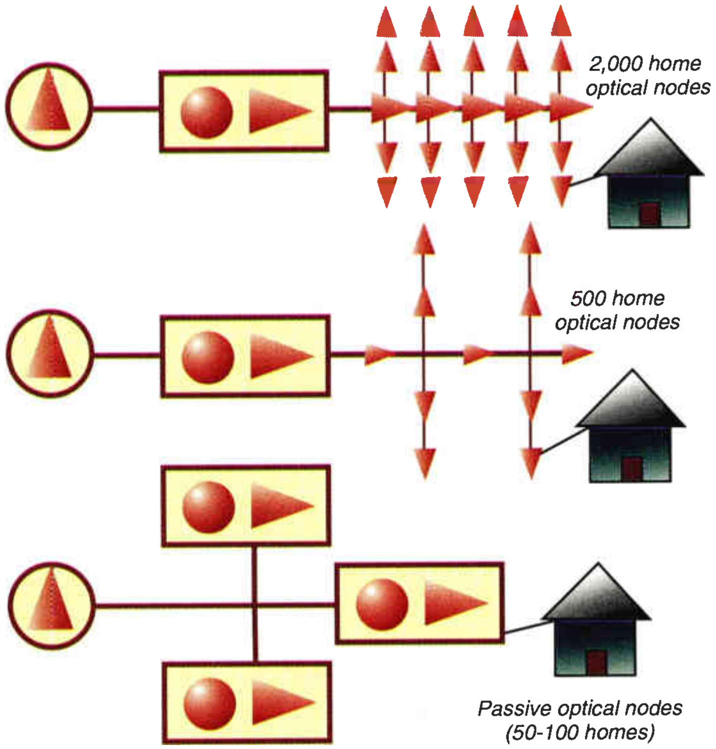
Interoperability of these three "platforms" over a single infrastructure will be as critical as the fine tuning of the HFC residential network, improvements in hardware and implementation of the integrated network management solution. Software development to ensure interoperability between various network elements/platforms and the rest of the public network will be essential to a successful "one pipeline" network that offers access to applications created anywhere.

Software development to ensure interoperability will be essential to a successful one-pipeline network

Toward the integrated network

The ideal network would be a totally integrated digital platform from the first day of operations. Ironically, this would negate the key advantage of HFC as a scalable, migratable infrastructure. The initial burden to implement an integrated digital platform remains excessive since no migration path based on proven new appli-

Figure 1: *Fiber as far as you can afford...*



cations is possible. In fact, the telephone companies looking at Fiber-to-the-Curb (FTTC) technologies face this issue. The FTTC full digital limited bandwidth delivery system requires complicated switching and digital-to-analog conversion even for basic cable delivery—from the start. Telcos contemplating FTTC deployment face a large capital investment, without an embedded base of customers to support that network deployment.

Unlike FTTC, the HFC access network supports a migration path toward an integrated voice, video and data communications platform—while maintaining what will become legacy service. NTSC analog video delivery, while today's primary cable TV service, will become that "legacy" service as digital technologies mature and equipment costs drop. Managing both analog and digital services via a single infrastructure is possible via the HFC platform. The format-insensitive nature of the HFC network means greater integration capabilities are possible. As new applications are added, the fewer independent systems to operate and provision within that network, the better.

Interconnecting headends remains a key issue. Today's applications may involve extension of the core business such as improved advertising insertion and operational economies. The regional network in the near future will provide the interface between the cable operator's network and many diverse elements in the public network. Regionalization will also provide the backbone for intra-regional platforms such as video file servers, the network management system and circuit grooming for signal transport via the Public Switched Telephone Network (PTSN). What may appear to be the low-cost solution today may be very expensive and restrictive tomorrow, if that solution fails to effectively interact with the public network and provide for commonality in operations between existing applications on the cable network.

In Figure 2, a high level view of the regional network shows how HFC and Synchronous Optical Network (Sonet) OC-n rings work together. Add application elements such as cable telephone devices, switches, cross connects, packet routers and file servers, and the importance of an integrated network management system is apparent. Operating multiple discrete networks in the long-term is at best limiting, and most likely a recipe for disaster. Sonet, the internationally standardized digital network that's already widely deployed in the PSTN, clearly offers graceful connectivity to the global network.

Many important and difficult interoperability and integration issues remain. Some of the more challenging areas include:

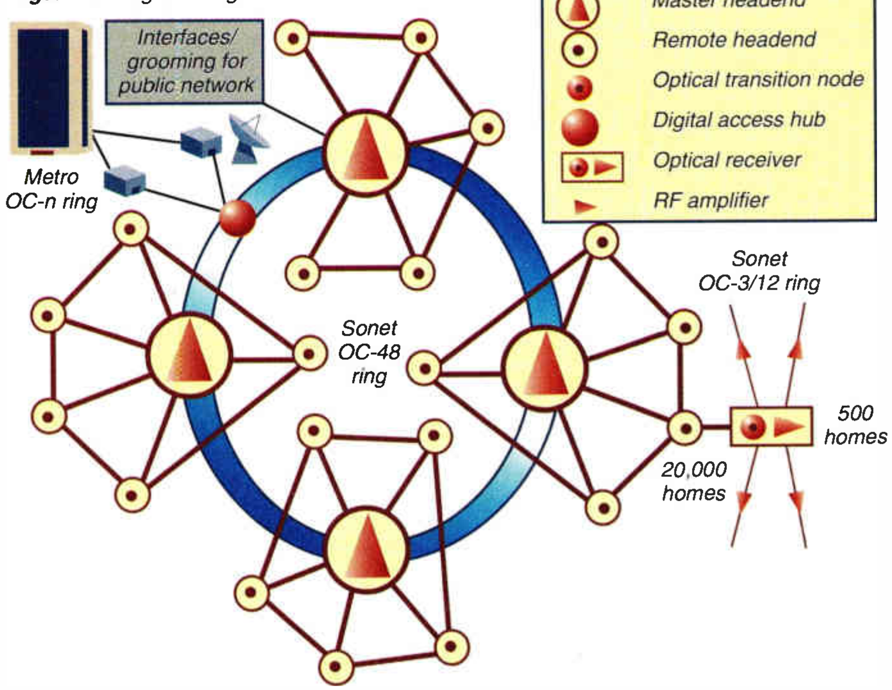
✔ Motion Picture Experts Group 2 (MPEG-2) and Asynchronous Transfer Mode (ATM) inter-mapping;

✔ Application, placement and migration of the video file server platform;

✔ HFC integration into Sonet and the public network switching infrastructure.

Recent large scale technology field trials, such as Time Warner's Full Service Network (FSN) project in Orlando, have provided important insights into these and other variables. The FSN approach identified many technical integration issues while focusing large and divergent interests from differ-

Figure 2: *Integrated regional network*



ent industries on developing practical solutions. Orlando gave us a peek at the onion's core. The long-term benefit will be to speed the development of viable, integrated hardware and software from resources in the cable television, telephony and computer industries.

Defining integration through standards

Development of appropriate standards will be a critical part of the HFC evolutionary process and of the use of ATM, MPEG-2, Sonet, video file servers, et al, within the evolving interactive broadband plant. The cable industry has never valued standards in the past since it was never required to operate in a standardized environment with its isolated broadcast networks. Future success, even survival, will depend upon compatibility with the public network and on efficient operations. A delicate balance exists between adapting standards too quickly and allowing proprietary systems to proliferate. There are no real standards groups sanctioned *by* the cable industry *for* the cable industry. However, there are no shortage of standards groups, some of which believe they are acting on behalf of the cable industry.

Along the way, appropriate industry standards will be embraced, perhaps modified to meet cable operators' needs. This process was evident with the MPEG-2 compression standards development for broadcast entertainment video. Many related efforts continue.

The model for the more complicated issue of technology integration may be found in the current process of resolving MPEG-2 and ATM compatibility. This is being worked out by specific and well-established standards entities with significant input from the cable television industry. This suggests a process where the cable industry looks at established standards groups in an a la carte fashion and devotes resources selectively in order to develop standards that apply to its particular needs and concerns. The alternative of ubiquitous representation in the literally hundreds of telecommunications standards groups is unrealistic, given the pace of network development and the resources at hand.

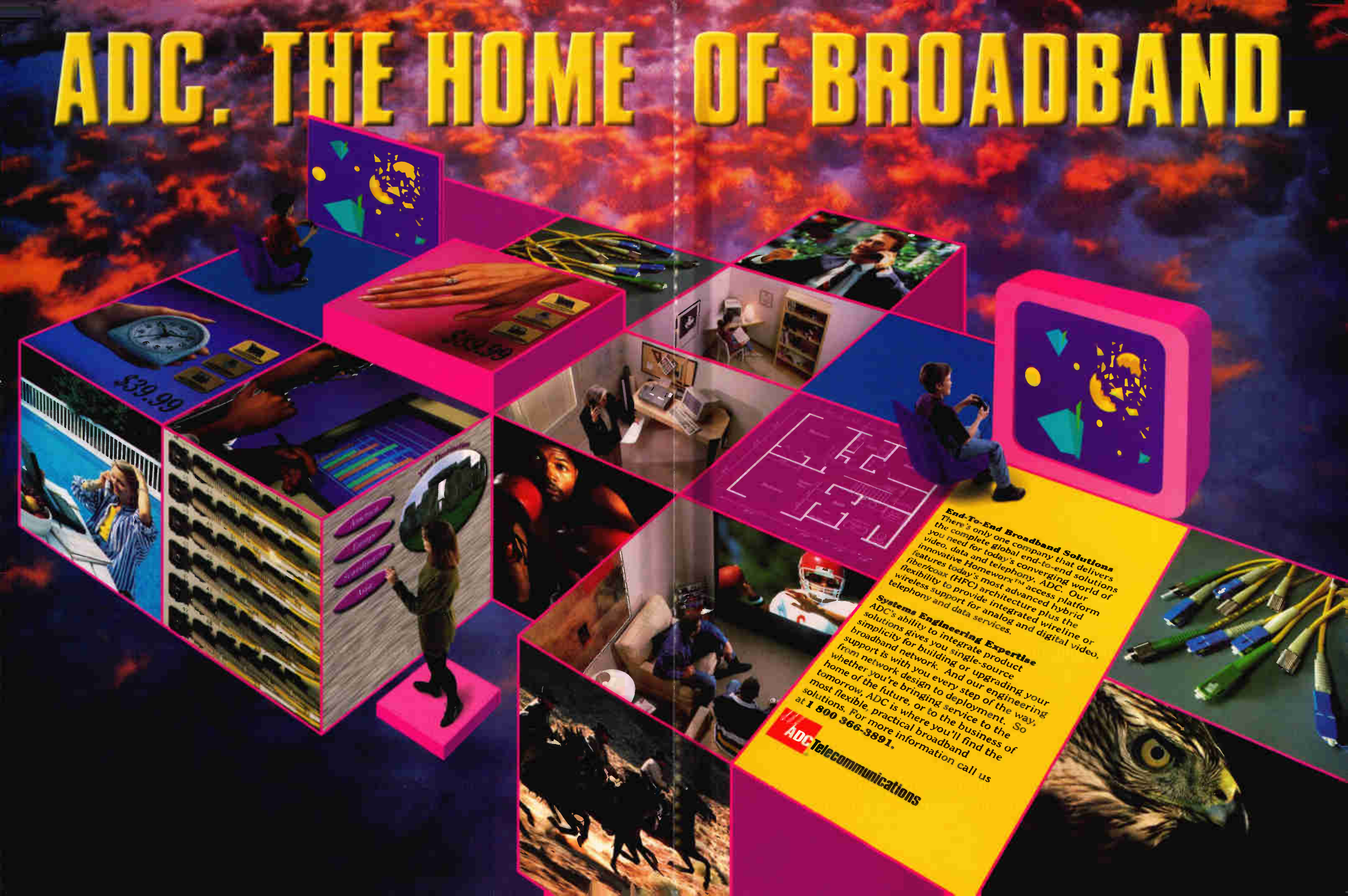
Integration requires some degree of experimentation and consensus

The other alternative–no standards development–will ensure long-term failure.

Integrating the "onion layers"

Bringing new services and technologies to the broadband network and integrating and managing those systems is easier said than done. The level of integration required in the next five years will be exceeded only by the level of circuit and component level integration required in hardware products. At the system and component level, integration will equal lower cost and greater flexibility.

Integration requires some degree of experimentation and consensus. Interoperability will permit integration, and standards will permit interoperability. As the telecommunications world grows more complex, the cable industry will be successful if it applies its traditional capability to grow its network incrementally, while effectively resolving the maze of new issues brought into focus as the onion is peeled back further. CED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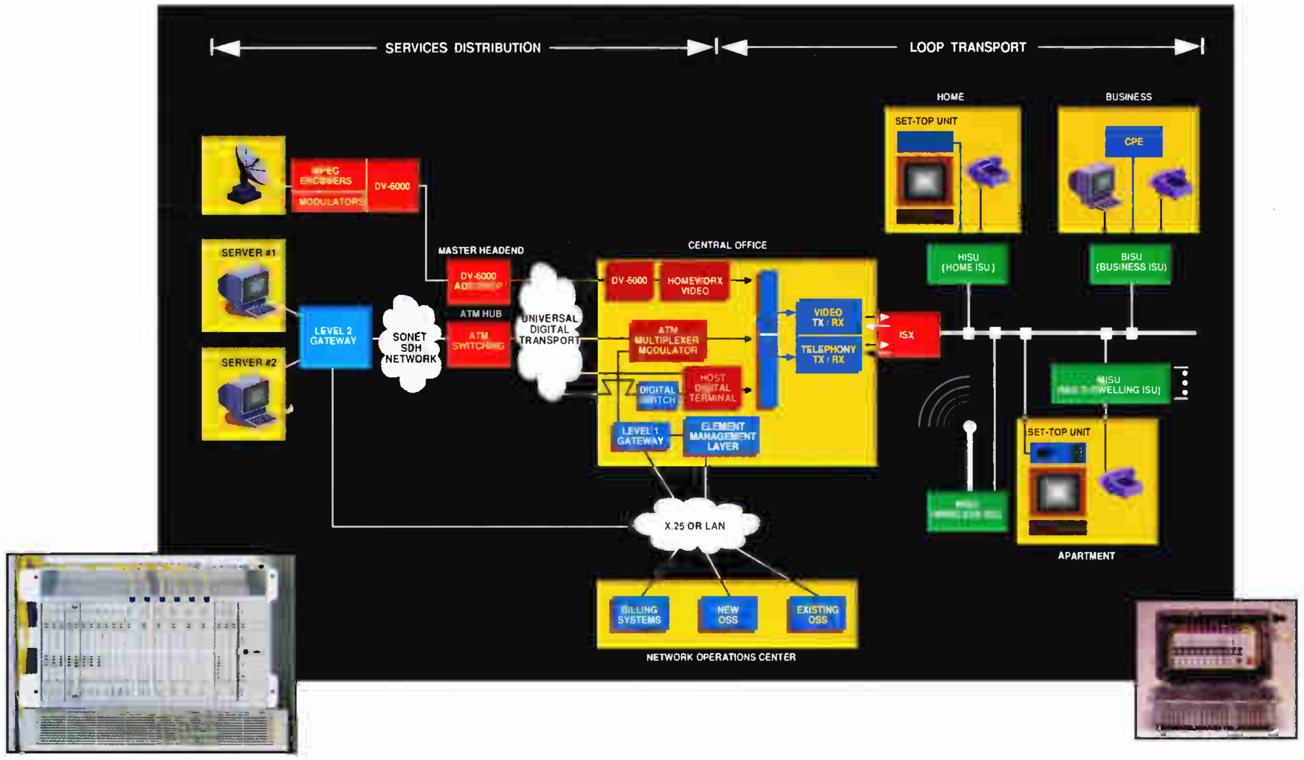
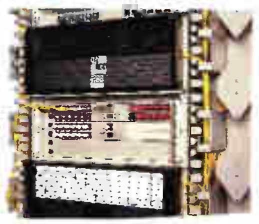


ADC is the leader in the development, design and deployment of residential broadband networks. Whether you're upgrading an existing telephony or video network or building it from scratch, ADC's Homeworx HFC access platform is the most cost effective, end-to-end transport solution available today. With flexible sizing and service components, the Homeworx platform permits a "pay-as-you-go" method of responding to changing technology and market demands.



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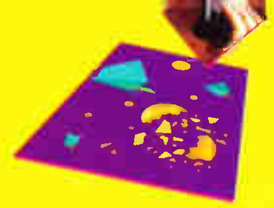


WHO

BUILDS

THE MOST

COMPLETE

RESIDENTIAL

BROADBAND

NETWORK

DELIVERABLE

TODAY?

An integrated telecom network trial

Lessons learned in Syracuse

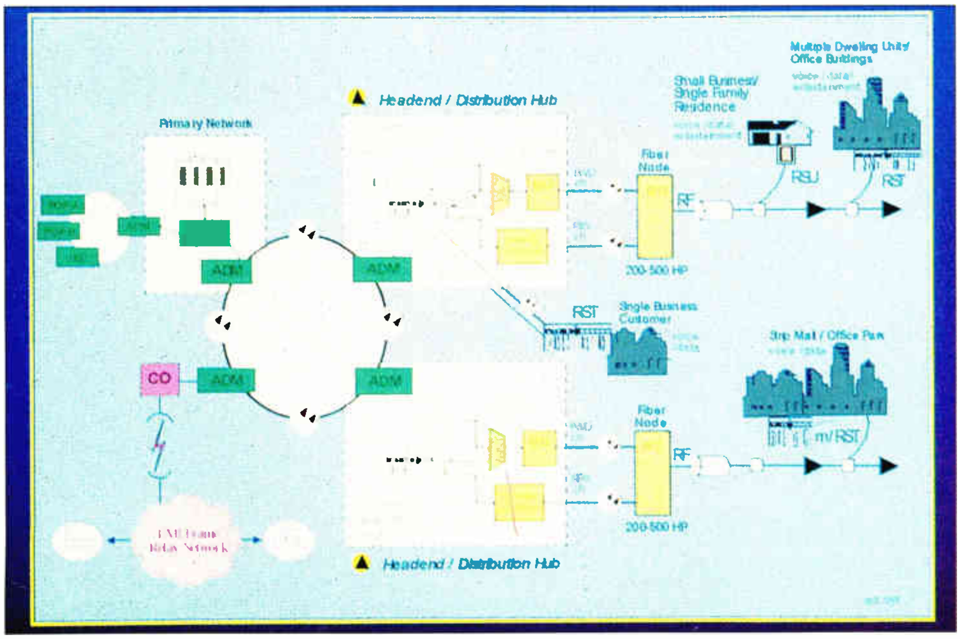


Figure 1. Stylized version of the Syracuse system

By Thomas J. Staniec, Director of Engineering, Time Warner Entertainment–Advance/Newhouse

***Editor's note:** While this article was originally written under the Newhouse/NewChannels banner, NewChannels has since merged into a partnership with Time Warner Entertainment–Advance/Newhouse.*

The investment of capital in the upgrade or rebuild of a cable television system today must now consider more than video. The deployment of a hybrid fiber/coaxial system has provided a network that is not solely a video-only delivery path. In fact, the cable system of yesterday no longer exists. Networks that are being deployed today are potential telecommunications platforms; however, saying you have a network does not mean you do.

This article explores the varied aspects of providing a wide area and regional telecommunications network. From the implementation of return networks, to the interconnection to the public switched telephone network, this paper details NewChannels Corp.'s experiences in an engineering telecommunications trial in Syracuse, N.Y. The engineering trial, with Tellabs Operations Inc., looks at return system operation, powering issues, integration from residence to business or interexchange carrier and the types of deployable telecommunications services. The trial started in mid-December 1994 and will run through the second quarter of 1995.

Overview

NewChannels Corp. has provided telecommunications services to corporations and other enterprises for 12 years. During the past two years NewChannels, in partnership with Hyperion, has provided competitive access services in the Syracuse, N.Y. and other areas. Concurrently, NewChannels has been rebuilding its franchises to hybrid/fiber coax (HFC) networks that support bandwidth to 750 MHz.

As these networks began to be placed in service, the decision was made to implement the return systems in some HFC node areas. The purpose of this exercise is to determine the operational impact HFC makes in smaller node areas. Typical node coverage is five to 10 miles in HFC, a vast departure from the 300 miles of open architecture return that at one time supported a cable security monitoring business. The cable security business still exists, but not in a two-way return network. The ingress problems that caused NewChannels to stop using two-way return fo security are the reasons and rationale for establishing HFC two-way return tests.

NewChannels has been testing return node for about one year. The result is that ingress, no matter how large or small the node, remains a problem. Tests and observation led NewChannels to the same conclusions that were drawn years ago–the inside of the house is the greatest point of ingress. The drop contributes to ingress at a significantly lower rate than the house. The hard coaxial cable and amplifier network can contribute, but are considered negligible. This is particularly true if strong signal leakage maintenance program in place.

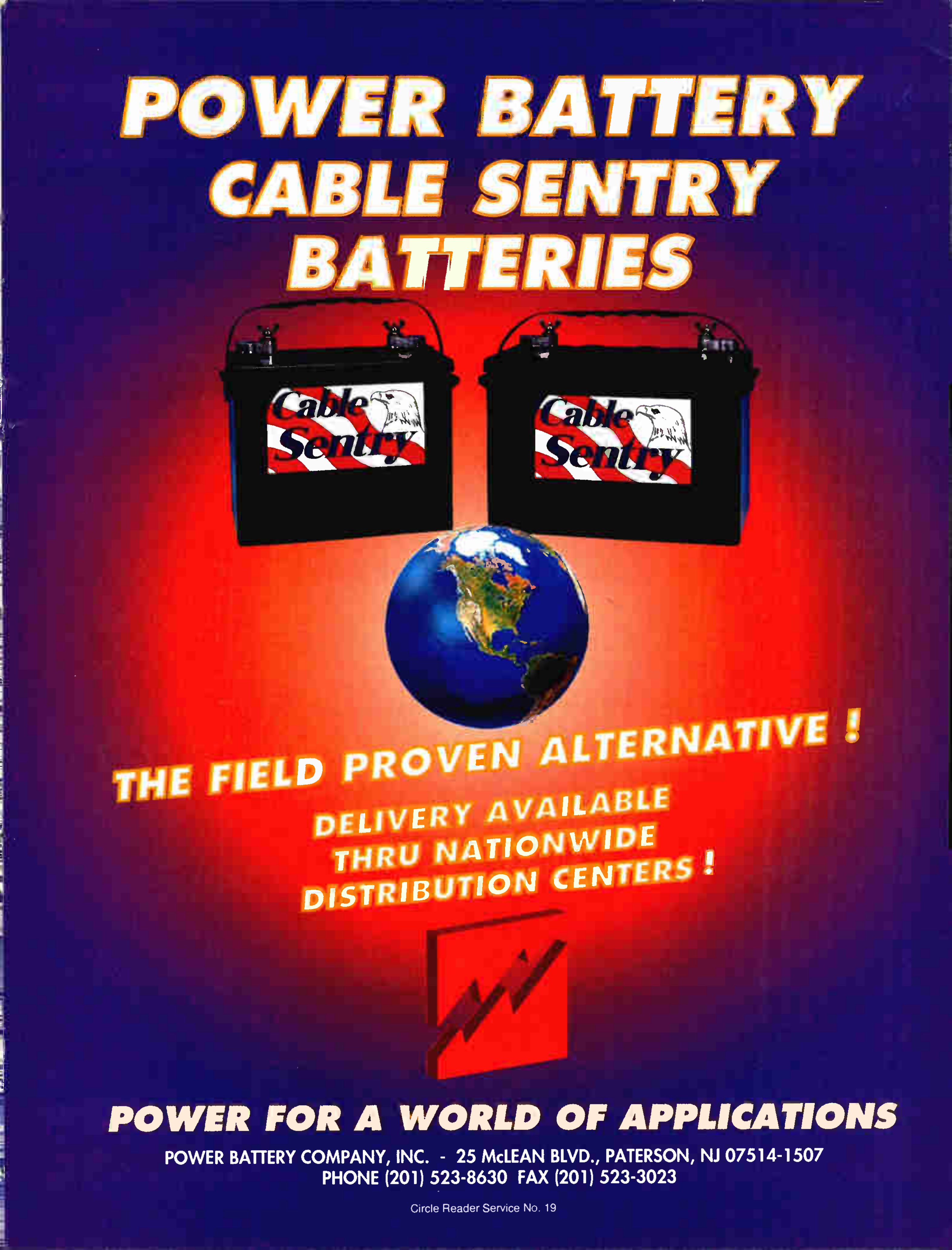
One purpose in building the network segments being assembled in Syracuse is the ability to bring a fully-integrated telecommunications network to its homes-passed base. NewChannels' 12-year background in telecommunications with corporate enterprises ha shown that there is more to telecommunications than the "path." Its enterprise cu have demanded a quality of service tha know respects their concern for their te munications services.

The company is now at the point whe can fully integrate a telecommunications work into its HFC design. It is now doing the engineering testing necessary to establish what is needed to provide telecommunication services of both value and quality to its homes-passed base.

Figure 2. Fujitsu OC-3 ADM

The network

The Syracuse a system consists of approximately 1,80 miles of plant, nearly all of which is HFC. The network covers an area that represents a variety of densities, from urban to rural. Generally, the fiber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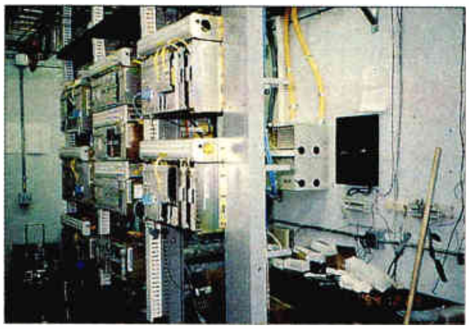


Figure 3. Network grooming facility

nodes serve pockets of 500 homes passed, but in more remote suburban and rural areas, the homes-passed numbers are less than 500 per node.

In some cases, distance from the primary headend serving an area required an optical drop and repeat location. In such cases, a significant amount of fiber is taken to the remote structure to support the forward and return fiber network to the headend. Beyond this structure, the number of fibers in the bundle exceeds the fiber count that connects the path between the headend and the drop/repeat structure. The intent is to consolidate return service from the nodes beyond the structure for return to the headend. All other nodes are directly fed back to the headend.

All power in these areas is standby or configured to easily become standby. In most areas, additional fibers are included in the jacket to support schools, businesses and other enterprises that exist on, or near, the fiber path. This was accomplished by using tapered bundling of fiber in the carrier jacket.

Once the fiber is terminated in the headend, return telecommunication services can be collected and cross-connected into a Sonet ADM (Synchronous Optical Network–Add/Drop Multiplexer) which exists in each headend. Figure 1 is a stylized version of the complete Syracuse area system.

Typically, the Sonet equipment is deployed so that the optics transmission path is an OC-12 (622 Mbps). The line side ADM in the headend is then set up to support an OC-3 (155 Mbps) signal. Figure 2 shows a Fujitsu OC-3 ADM in the headend. Note the cross-connect panel and self-contained battery system in its own enclosed equipment rack.

Generally provided at that point is DS-1 (1.544 Mbps) service, deployed as needed for support of telecommunication services into and out of the HFC network. The provided services are modulated on RF carriers and sent into the broadband coupling network for delivery to the lasers. Currently, the powering arrangement for the headend provides for normal power company input power, attached to a UPS system which supports the whole headend. The battery plant for the UPS system will support the headend for 10 to 30 minutes. During that time interval, a frequency and voltage-stabilized propane power generator is brought on-line which can operate for extended periods to support the overall mission. The Sonet ADM is attached to those systems, in addition to a -48 volt DC rectifier and battery system to protect that Sonet terminal.

Figure 4. Battery powering for grooming facility

The Sonet network leaves the headend on a fiber path that is a protected ring with divergent routing. Divergent routing extends to the central office (CO) and headend buildings, where the fiber leaves the buildings on two different paths. This assures the protection of both the system digital video and telecommunication product delivered to any location.

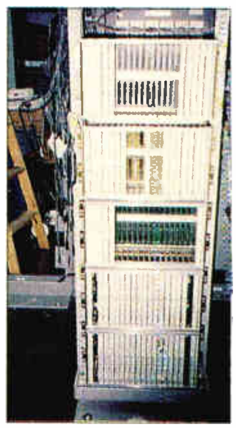


Figure 5. DAC for cross-connect

The Sonet network in this metropolitan area is composed of multiple rings. These rings not only enter NewChannels' facilities, but also numerous enterprises and interexchange carrier (IXC) facilities all on redundant paths. One of the main facilities at which all traffic is handled is the network grooming facility. Figures 3 and 4 show a network grooming facility and the battery powering for that facility. This is a CO where all traffic can be taken off the rings, disassembled and then reassembled through a

Figure 6. AT&T 5ESS switch

digital cross connect system (DACS) for delivery to either the proper IXC or customer. Figure 5 shows a DAC used for network grooming and cross connecting traffic that is coming in from various fiber rings.

Each customer location has its own Sonet entry point into a ring. Generally, all customers are dual-homed to two COs. That gives customers redundancy out of their own facilities. The Sonet network in this system is provided by Fujitsu, while the Tellabs DACS is located at the grooming facility. The network management system was originally located at this facility, but has since been moved to a facility managed by Hyperion. Full network management is also retained at the grooming CO.

The AT&T 5ESS switch is deployed in a separate building fed as a Sonet ADM node. The unit is modular, state-of-the-art and configurable for a vast array of services. Figures 6, 7 and 8 are of the AT&T 5ESS switch. Figure 6 shows one half of the equipment bays needed to support the 5E; Figure 7 is one of the switching bays for call set up; Figure 8 is the brain of the switch. Note that the equipment is redundant above and below the cooling fans.

The powering network is comparable in design to the one described for the headends, but has a significantly larger battery system.

Currently, NewChannels has access to 10,000 phone numbers in the form of (315)-234-0000 through 9999. The numbers will primarily be used in the competitive access business, but a small group has been set aside for the engineering trial. This switch supports Bellcore documents TR-NWT-00008 and -000303, which deal with the operation of digital loop carrier (DLC) systems in conjunction with a local digital switch (LDS). These are not the only Bellcore documents that deal with this network architecture or these services, but they are the ones on which this engineering trial is based. The Tellabs Cablespan 2300 product line (a next generation DLC system) is based on these, and other, Bellcore documents.

Figure 7. A switching bay for call set-up

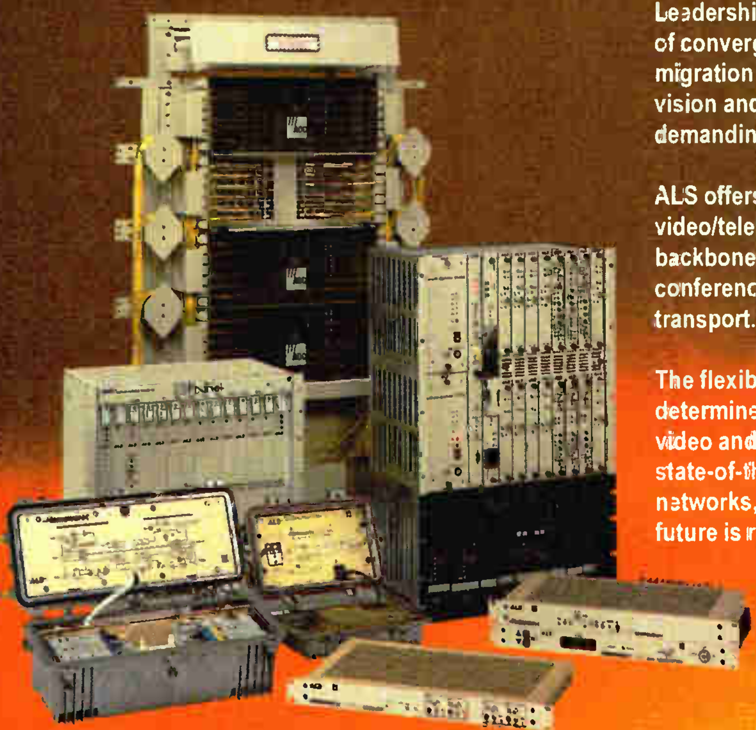
The trial

The scope of this trial involves the delivery of telecommunication services in a switched environment to NewChannels personnel. The purpose of the trial is to help NewChannels and Tellabs understand the dynamics involved in the delivery of communications through a fully integrated system into an HFC network. It seeks to establish whether HFC-DLC is a viable method of telecommunications delivery in a significantly large area. Some of the issues that the trial hopes to expose are:

✔ Does the system work?
✔ How does it work over a large area?
✔ What is the impact of ingress?
✔ What is the effect of impulse transients?
✔ What level of technical competence is needed to operate the network?
✔ What are the benefits and drawbacks to network management systems?
✔ What are the powering issues?
✔ What applications can be supported on, and through, the network?
✔ What levels of reliability, security and quality can be expected?

Figure 8. The "brains" of the switch

The Tellabs Cablespan DLC equipment consists of three basic parts. The first is the headend piece, called the host digital terminal (HDT). (See Figure 9). Note that it is a small, card-configurable unit that allows for many options in one chassis. This unit interfaces with the HFC network as an extension of the LDS. The HFC network interface units come in two basic varieties, with equipment variations under the primary headings of the remote service terminal



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(RST) and the remote subscriber unit (RSU). Figure 10 shows an RST in the same chassis as the HDT. Figure 11 shows the RSU.

The RST can operate in a stand-alone fiber, copper or HFC network, where multi-line service and connectivity are needed. The RST would be used in business, enterprise or multiple-dwelling unit locations where a wide range of card configurable applications might be needed. The RSU family units are directed at the residential market. These units will not be involved in the trial at the time of startup, but will be brought into the trial when the engineering design is completed.

Description of the full, operational network is beyond the scope of this article. Yet the overview presented here should help clarify how a resident is served when there is no physical copper pair connection between the CO and the resident.

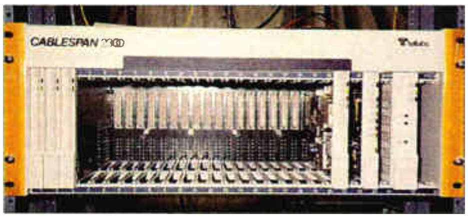


Figure 9. The Host Digital Terminal

Digital loop carrier, or DLC, is based on the building block of a DS-1 signal package. A DS-1 signal has a digital rate of 1.54 Mbps and represents 24 64-kbps data channels. Each channel can carry either voice or data communications signals. Multiple DS-1 signals can be multiplexed together. The model below describes the distant subscriber's attachment to the switch as though it is a dedicated 1:1 relationship. This would equate to each subscriber having a fixed timeslot position in a DS-1 that is tied back to an LDS port. While allowed by Bellcore, this is not a cost-effective engineering practice. Options exist which involve dynamic assignment of timeslots, line contention by traffic modeling and concentration. These are merely mentioned here.

At the LDS, a phone number is assigned to a timeslot in the DS-1 designated to serve a particular customer from an HDT. The DS-1 is added to the Sonet ADM at the LDS and directed to the grooming CO. At the location, it can be cross-connected to a Sonet path which feeds the headend with the proper DS-1 to the desired HDT. This circuit administration process and setup is typically done only once. From that time on, the DS-1 signal will always show up at the same location. The Sonet network will transport the DS-1 to the proper ADM and off-load it to the HDT on a DS-1 interface. This assumes that only one DS-1 is being transported on the Sonet network.

At the HDT, the DS-1 is RF modulated and applied to the combining network, where it is delivered to the HFC lasers. The HFC network carries it to either an RST or RSU. Those units form a point of demarcation to which the consumer's phone attaches. The phone operates just as it would if it were attached to a CO by copper pairs. Well. . . almost.

In a copper pair environment, the power required to operate the network comes from the battery plant located at the CO. A telephone-based DLC system deployed to a service area would still draw battery from the telco. The use of HFC-DLC demands a hard look at how power must be provided for phones on an HFC network. Possible options are: the RF power network, house power, or house power with battery back-up. NewChannels will be trying the options.

The network powering option will be done with a device from Philips Broadband Networks referred to as a "power picker." The unit screws into the back of a directional tap and "picks" the power off the seizure screw. This will allow access to 60-volt AC to send power to either the RST or RSU on a siamese coax drop cable with 24 gauge copper pair tied to it. This method was chosen because there are few power-passing tap product options in the marketplace, and NewChannels did not want to replace taps it had just installed.

At some point, if telephone service is offered, all of the taps will have to be changed to a power passing variety with a "no break" AC and RF path through the tap. This assumes network powering, a point which will be argued for awhile. Concern exists over a power-passing tap which uses the siamese approach for providing power to the network

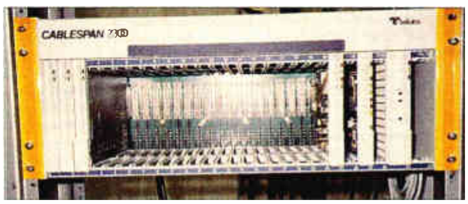


Figure 10. The Remote Service Terminal

interface, since the return network must be kept clean and free of ingress while simultaneously being attached to unshielded copper pair. Even though the power feed is RF choked, this may not be adequate to protect against ingress intrusion into the return by way of the "hanging copper antenna" attached to the drop coax.

The last topic is signaling. Signaling lets the customer know about incoming calls and ultimately lets the LDS know about an outgoing call. Signaling in a HFC-DLC is a two-stage system. The first stage, in an outgoing call, is the subscriber network interface sending an off-hook message to the HDT, which establishes a bi-directional path between the HDT and the network interface (NI). The network interface is either the RST or RSU. The HDT establishes the link to LDS by the use of bit rob signaling in the DS-1 signal to the LDS.

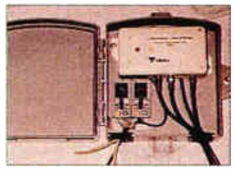


Figure 11. Remote Subscriber Unit

Once this path and the HFC path are established, the LDS places dial tone on the path to the subscriber. The dialed phone number is entered by the subscriber and carried in-band back to the switch for interpretation and connection. A detailed description is not given here to protect proprietary information about the HDT to NI connection. It is important to understand that specific protocols exist that deal with call setup and tear down in a normal telephone network. In an HFC-DLC network, there are more steps in call establishment.

Objectives and conclusions

The objectives of this trial are quite simple. First, demonstrate and provide a return network that is clean for the trial. Second, install and test the telecommunications equipment in this clean environment to establish that it works. This objective sets a baseline for further testing. Third, integrate the network end-to-end with Sonet and the LDS, making sure of proper operation. Fourth, fail the network in every conceivable way, developing an understanding of how the telecommunications equipment is affected. This will show how bad the return network can be before communications fail. Modeling can be done to determine if the return can be supported above the failure level. Fifth, implement a wide range of applications in the network to understand what it will support and if there are any sensitivities in the transmission medium.

Drawing conclusions right now may be premature. The first phase of the trial involved Tellabs observing and participating in the clean-up of a return network. Tellabs found the experience to be eye-opening. The return spectrum that existed before the clean-up would not have supported telecommunications with a reasonable level of quality. We know that we can clean up the return band; the open question is, "Can it be kept that way?" Tellabs and NewChannels will be developing the answer to that as the trial goes forward. CED

How one MSO got started in datacom

An inside look at EC Net

By Roger Brown, Editor

While many cable systems are just now beginning to explore their options for datacom provision, at least one MSO is already on the fast track of delivering high-speed data to a multitude of sites over its existing cable TV infrastructure.

Times Mirror's Dimension Cable system (now a Cox Communications system) in Phoenix, Ariz. has allied with Arizona State University and Digital Equipment Corp. to deploy "EC Net"–a metropolitan area network that ties approximately 12 manufacturing companies together via a FDDI (fiber distributed data interface) ring featuring 100 Megabits per second shared throughput. The result is a network literally bulging with capability that supports multiple users of files, all without encountering a busy signal.

Moving down through the network, the ring connects three Dimension headends and another located on the ASU compus, all of which serve as Ethernet LAN segments, which in turn connect to the end-user sites. Headends as far away as 36 miles are tied into the ring, and the longest trunk run is 15 miles. See Figure 1.

Network components include: bridges, which convert digital data to and from 6 MHz signals; routers, which direct multiprotocol traffic between addresses on the network or to the Internet and other WAN connections; videoconferencing hardware; software that supports collaborative CAD and other applications; a data/multimedia server; workstations; and a network management system. Network security includes constant monitoring, file encryption, protocol monitoring, auto alerts and lockouts, among others.

EC Net actually had its genesis a few years ago, in what started as a campuswide connectivity effort by ASU. Student dorms and university buildings were interconnected with Digital's ETB-1 bridges to share information.

NAFTA's effects

When the North American [illegible] Agreement came about, the s[illegible] became concerned that it mig[illegible]-tial number of manufacturing jo[illegible] the state's southern neighbor that [illegible]st supply of low-cost labor.

To help keep those jobs in Arizo[illegible]al key Phoenix-area manufacturers we[illegible] approached to determine their needs [illegible]er to streamline operations and reduce [illegible]ey

Survey says: Datacom is real business for MSOs

Not sure there's a market for high speed data services over cable TV networks? Private companies, government agencies and education facilities are chomping at the bit to get high-speed access to data and the Internet, according to the results of an exhaustive survey undertaken by Digital Equipment Corporation.

Digital distributed 73,000 surveys late last year to government, education, health care and manufacturing companies as well as commercial Internet users to gauge their interest in accessing data at high speed. To date, nearly 10,000 surveys have been sent back and 80 percent said they were "very interested" in such services. The type of response and huge number of returned surveys have Digital executives grinning from ear to ear.

"The speed, size and enthusiasm of the response to the survey show that business wants high-speed, multimedia communications over cable's broadband network, and wants it now," says Lois Levick, marketing manager of emerging network technologies for Digital's Network Product Business unit. "There is pent-up demand for these services. The need is more immediate than I anticipated," she adds.

Corporations are interested in the cable network because its high bandwidth and multippoint distribution allows them to implement multimedia applications such as manufacturing design, video teleconferencing, distance learning, telemedicine and access to Internet and other on-line services, say Digital executives. Many survey respondents also expressed interest in using the cable TV infrastructure for telecommuting applications.

In response to the survey results, Digital contacted nearly 3,500 cable TV systems and offered an evaluation form to help them determine if their plants are ready to offer data communications. About 250 of those systems have already taken Digital up on the offer.

Again, many wanted immediate information about their plants. Digital's engineers determine suitability for datacom based on several factors, including channel availability, signal levels and various aspects about the plant that would put the products in the best environment, says Levick. "The MSOs are actually talking to us–and that's thrilling," she says.

One convert is John Liskey, TCI's director of government and public affairs in Michigan: "Data communications over two-way activated cable is a tremendous business opportunity," he says. In East Lansing, TCI ran several pilot programs aimed at the health care, government and education markets and has since turned those pilots into a commercial venture with paying customers. "The market is demand driven at this point," adds Liskey.

Levick intends to make other MSOs aware of the opportunities for datacom through continued communication. "I want the noise level to be high," says Levick. "I want them (cable operators) to pla[illegible] it, to budget it in their rebuilds."

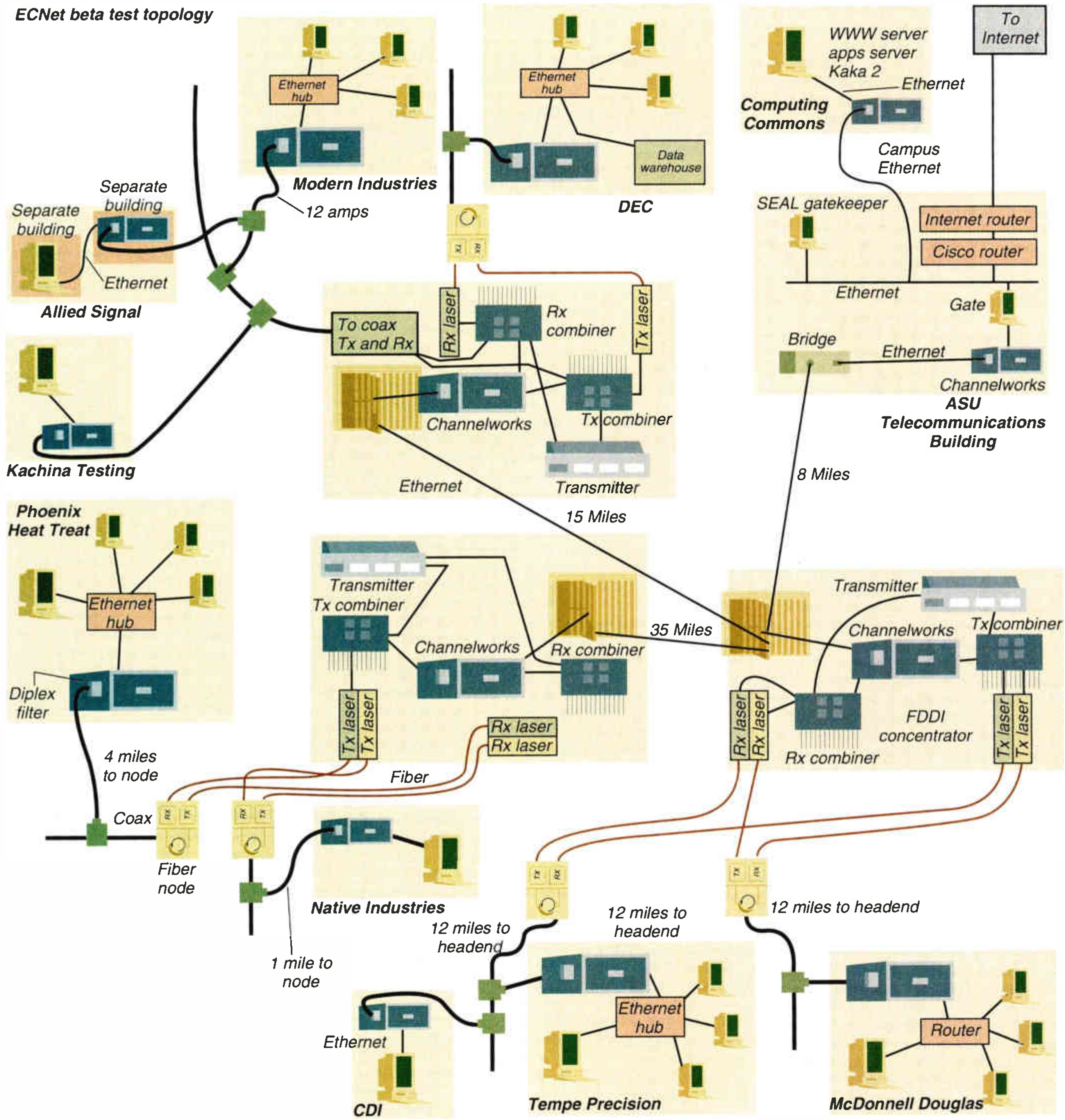
–R.B.

needed a way to access huge data files, share them with colleagues or subcontractors located across town, make real-time changes, and videoconference with each other–quickly. The key was to find a way to reduce the Request For Quote cycle, which was estimated to account for 60 percent of a design cycle time. Telephone lines, even at T-1 rates, couldn't handle the job. What was needed was a bigger pipe.

Seeking a proving ground for its new Channelworks product (a successor to those early ETB-1 bridges), executives from Digital approached Times Mirror's corporate officers during the Western Cable Show in 1992 about using the cable TV infrastructure as the backbone for an "electronic commerce" network that could serve these manufacturers. Agreement was reached to deploy the first phase: a 22-mile link connecting Motorola University, Mesa Community College and Arizona State University. After nine months, the system had proved its reliability. Now it was time to talk to the manufacturers.

Building trust

In retrospect, DEC had a lot to prove to Times Mirror, says Mike Huffaker, network technology consultant for Digital. "It took a lot of trust. We had to prove we wouldn't



bleed over into the entertainment video," he notes. The concerns were real: downstream signals are sent in a channel between 336 MHz and 342 MHz, putting it right next to Dimension's pay-per-view service, Huffaker notes.

What EC Net had to offer manufacturers such as McDonnell Douglas, Tempe Precision Aircraft, Phoenix Heat Treat, Kachina Testing and others was, quite simply, a method to make products better, cheaper and faster. These types of companies were used to long delays in both planning and production when design or manufacturing changes were introduced. This network promised to make users more competitive by reducing product design and procurement cycle times; increasing productivity through improved communications, fewer changes in product design, fewer meetings and enhanced collaboration between groups; reducing the amount of documentation; and better quality control through error reduction and improved part conformance.

Since its humble beginning, the project has been expanded to include about a dozen manufacturers, who use it for a wide range of applications, including:

Since its humble beginning, the project has been expanded to include about a dozen manufacturers

✔ Desktop videoconferencing supporting several real-time participants who can view production floor manufacturing processes, prototype parts and other applications

✔ A concurrent computer-aided design (CAD) tool that allows multiple remote users to view and annotate CAD drawings interactively, using multiple commercially available CAD programs

✔ A "white board" that allows multiple remote users to view and annotate the same text, graphic or document

✔ Telecommuting capability

✔ High-speed access to the Internet for e-mail, accessing resources or downloading software, pictures, etc.

✔ A multimedia "warehouse" that facilitates sending, storing and retrieving files, video, images, purchasing specs, catalogs and other information.

What made this project work was the expertise brought by the three participants. Digital brought the technology, products and computer networking skills; Times Mirror offered its physical plant for transportation and its marketing prowess; and Arizona State University brought Internet access at T-1 speeds, awareness and neutrality to the project.

Digital had a product it needed to test, Times Mirror wanted to test the concept to see if it had economic viability, and ASU wanted to get its feet wet in the distance learning arena.

Lessons and obstacles

Complicating the implementation of the ECNet was Dimension's planned upgrade to a hybrid fiber/coax network topology with

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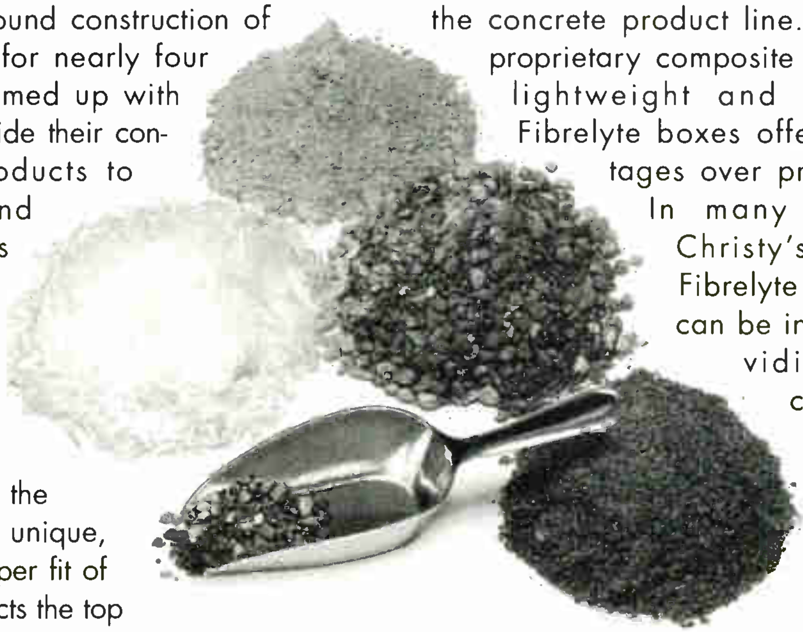

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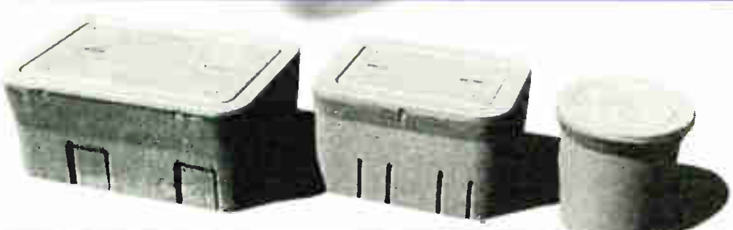

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750 MHz bandwidth and active two-way return. While the addition of fiber actually made the return path more robust and less susceptible to ingress, a significant amount of effort was needed to bring the reverse plant up to Digital's specs for data transmission.

"Doing all the homework upfront is critical," notes Lois Levick, marketing manager of emerging network technologies for Digital's Network Product Business. "It's important to plan peroperly–get out there and do the tests, don't just make assumptions about the plant."

Huffaker says the amount of work needed on the reverse plant surprised him initially. "Operators need to be worried" about the viability of the return path, he notes. At Dimension, the assigned reverse data channel is T8, located between 11.75 MHz and 17.75 MHz. That's not considered to be the most friendly chunk of spectrum, as it is shared with amateur and shortwave radio operators.

So far, however, the equipment has operated without a hitch. But that doesn't mean there haven't been some minor problems: On two occasions during construction, amplifier housings were removed and reverse transmitters were forgotten. Another time, a test signal was sent over the same frequency, knocking out the communication link. "Most problems have been human error," concedes Huffaker. Network uptime has exceeded 99 percent since it was turned up and so far, the Channelworks bridge hasn't failed once.

Future plans for the network

A link to the Public Switched Telephone Network is being planned, and wireless links are also being investigated, although there appears to be some stumbling blocks related to the Arizona state constitution, according to officials from Digital. A new pilot program for telecommuters should be undertaken later this year, however, giving Cox a chance to capitalize on an application many consider to be cable's real ace in the hole.

Network uptime has exceeded 99 percent since it was turned up

Digital executives note that the new pilot programs Cox has planned show the limitless opportunities of such an extensive and powerful network: "This solution isn't just for manufacturing companies," notes Rhonda Bruce, a Digital business consultant, "it can work for governments, health care providers, retailers, and others."

Huffaker agrees: "People have to move beyond the applications and start thinking about how much bandwidth they need and where they need it." CED

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Synergistic swap meet, or no deal?

Cable, utilities explore partnerships

By Dana Cervenka

Competition definitely makes for strange bedfellows. Though there have been several announcements of alliances for energy information services and management between utility and cable companies in the news recently, many wonder whether the two industries, traditionally wary of one another, can really work together for mutual benefit. And then there's the issue of corporate culture. Can the ultra-conservative utilities find happiness with the entrepreneurial MSOs?

Maybe so. New ventures between the two industries include the formation of CableUCS, a consortium representing Comcast Corp., Continental Cablevision, Cox Communications and Tele-Communications Inc. (TCI), which is on a mission to build relationships between cable operators and electric, gas and water utilities. Collectively, the members of the consortium cover 30 million subs in 48 states, and are looking to create a range of broadband services including automated meter reading (AMR), outage detection, real-time energy usage and pricing information, and a range of other offerings.

Also in the news is a trial involving Pacific Gas & Electric (PG&E) and TCI in California, as well as a pilot program instituted by Public Service Electric & Gas (PSE&G) which utilizes AT&T's broadband utility solution.

Why are these partnerships coming together now? One answer is that there are currently outside forces driving the two groups together. Both industries are re-examining their business strategies as extraordinary, sweeping changes compel them to find new ways to attack the marketplace. For utility companies, deregulation and the impending onslaught of competition are forcing them to seek new sources of revenue, while at the same time, encouraging them to shore up relationships with their existing customers. In one example, with estimates of per-customer investment in the $6,000 range, electric utility companies view the loss of a client to a competing, independent producer with horror.

For MSOs, the challenge is to maximize the full service broadband network for the greatest number of services, while fending off the telcos and other would-be competitors. In order to add value to their services, utilities need a means of two-way communication between their facilities and their customers; cable companies need additional revenues to combat rate regulation, and to finance and accelerate the construction of the information superhighway.

Bartering makes a comeback

But there's more to the picture than that. In the partnerships being forged between utilities and cable companies as of late, some things may be more important to the players than having fists full of cash immediately in hand.

Cable could use energy management services as an entrée into the homes of non-subscribers

Alliances such as the one recently announced between TCI, PG&E and Microsoft for the joint test marketing and development of energy information services over the broadband network will allow the players to swap tangible, as well as intangible assets.

TCI is conducting discussions with several utilities, notes Les Larsen, a consultant with TCI, "and we are all looking at entirely new ways of packaging, of bundling services. For example, consider the possibility of delivering energy, plus entertainment, plus telephony, and packaging all that to sell it to a consumer at a special, discounted rate."

There are other possibilities, as well. In exchange for the use of an MSO's network, a utility could provide the MSO with extra power for its own operations, or the utility partner might be willing to bestow its right-of-way privileges on the MSO as "payment" for the use of network capacity.

What's more important, these partnerships also have implications for extending cable's reach into a greater number of homes. Riding on the back of a utility's 100 percent penetration of its service area, cable could use energy management services as an entrée into the homes of non-subscribers.

Clifford Schrock, president of CableBus Systems Corp., a manufacturer of broadband telemetry products, has a slightly more cynical view of why the two industries are now coming together: fear. "The utility companies in a lot of little towns have said, we will build our own networks, and we will compete with you," says Schrock.

According to a report released by Andersen Consulting, however, most utilities stand to lose if they construct their own networks, rather than choose to utilize another operator's communications infrastructure. "Although most utilities already have extensive communications capabilities," according to the report, "utilities would need to build connections to a large number of end-user customers; this would require a substantial capital investment." To quantify that investment, even if a utility already has its backbone network in place, Andersen estimates that it would cost between $1,660-$2,000 per customer to build the "last mile" broadband connection. In cases where the backbone communications infrastructure would also need to be constructed, costs would obviously be much higher. As the Andersen report notes, "Utilities have experienced costs ranging from $50,000 to more than $65,000 per mile to build a fiber backbone network."

Well-kept secrets

Some smaller cable companies have already quietly entered this new arena to find additional sources of revenue. Blue Ridge Cable TV in East Lancaster, Pa. has been reading water meters for the local utility for eight or nine years, according to Schrock, "and every month, the water company hands them a check for $20,000." Farther south, American Entertainment Cable in Richmond, Ky. has purchased equipment for a pilot project from Schrock. That project involves electric meter reading, load control and message displays, and encompasses 20 homes in the operator's Lexington, Ky. system.

On the utility side, one company which

chose to build its own system is the Glasgow Electric Plant Board in Glasgow, Ky. Glasgow was one of the first municipal utilities in the United States to build a broadband communications system alongside its electric facilities to offer cable TV and telephony, as well as the provisioning of electric power.

Recently, a series of high-profile trials being conducted by MSOs have also been announced. One of these is the Energy Information Services (EIS) trial in Walnut Creek, Calif., a joint effort between TCI, Microsoft and PG&E Enterprises, which will be expanded to 100 homes in both that city and in Sunnyvale, Calif. sometime this month. (In early '96, the trial will be further expanded to encompass 1,000 area homes.) TCI is providing the broadband network, as well as a specially-modified, custom set-top for the trial; PG&E is responsible for the energy application software, as well as technology for the inhome energy network that facilitates communication between the appliances, an energy management unit, the meters, and the set-top; and Microsoft's portion is the operating system software that manages the application, set-top and head-end software.

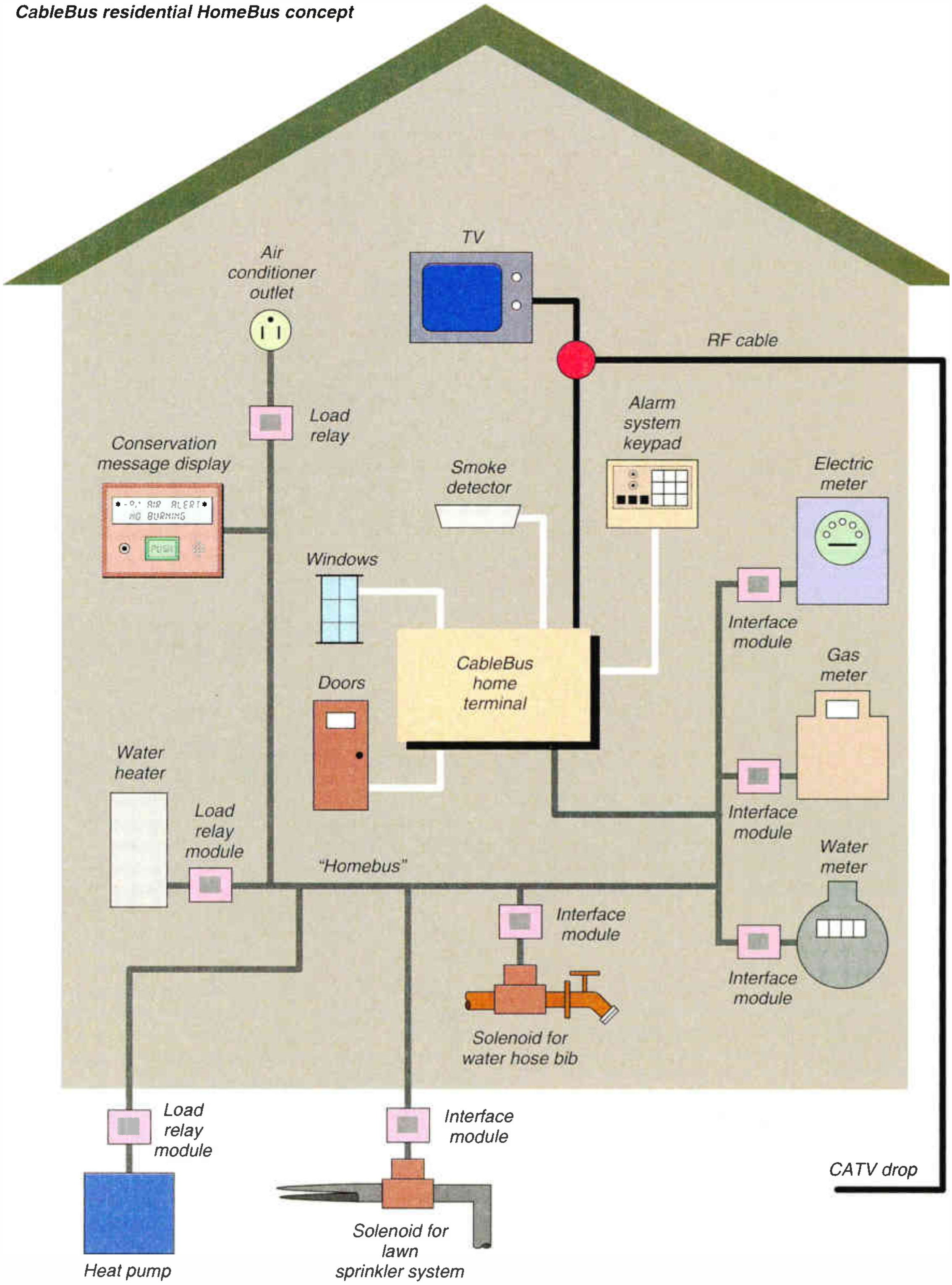
Customer control

PG&E has both marketing and technical goals for the trial, including determining the value of the services to its customers, estimating the internal savings that could be achieved, defining a service packaging scheme and developing commercial energy information services as a whole. Services under test in Walnut Creek include automatic meter reading, real-time energy cost and time-of-use information, home automation for security and lighting control, appliance monitoring, HVAC control, on-line energy usage and forecasting and electronic billing and bill payment.

What's especially noteworthy about the trial is PG&E's utilization of distributed load control, which in effect, gives pricing signals to customers so that they can make their own informed choices about their energy usage, as they weigh comfort and convenience against savings, based on time-of-use rates in their energy bills. Trial participants control their energy usage by accessing a menu on their television screens via their set-top boxes.

One of the major challenges to making commercial deployment of the technology fea-

CableBus residential HomeBus concept



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sible is the cost of the prototypical gear. "We have to drive the cost out," says Steve Phillips, director of energy systems automation, and project manager for the Walnut Creek trial at PG&E. "It's hard to even find places that make this type of equipment." PG&E is hoping that the agreement it recently signed with Swiss-based solutions provider Landis & Gyr to develop equipment for Phase 3 of the trial is a step toward making the technology commercially viable. If the trial is ultimately successful, the resulting energy information services will be marketed on a nationwide basis.

Integrated systems

Another member of CableUCS, Cox Communications, has announced a trial with Northern Telecom (now known as Nortel) for integrated energy management applications, digital telephony, data and video over its HFC network in its Hampton Roads, Va. system. Cox is also in the planning stages of a trial with Southern California Edison in Orange County, Calif. involving an AEM (Advanced Energy Management) system, according to Paul Spaduzzi, a consultant to Cox. That trial will be structured to provide meter reading, billing, customer control of appliance energy usage and customer usage rate comparisons.

AT&T, which recently teamed with Public Service Electric & Gas (PSE&G), American Meter Co., Andersen Consulting, General Electric, Honeywell and Intellon to develop the AT&T Integrated Broadband Utility Solution, has also announced a trial with development partner PSE&G to test broadband applications. The pilot program is slated to begin this year and will be expanded to include 10,000 residences and businesses sometime in 1996. The utility solution will provide for remote meter-reading, power outage detection, real-time load management and warnings of meter-tampering. In the future, the system will also provide for customer-controlled load management and other value-added services.

System requirements, equipment

System upgrades undertaken by many MSOs have created networks that are well-suited to offering the full slate of energy information services. From a purely technical standpoint, the low bandwidth requirements of these services are good news for operators–as an example, Shrock says that his telemetry system can conduct energy management services for an entire town by utilizing only one-quarter of one megahertz of bandwidth, located in a gap in the guardband in both the downstream and the upstream.

Shrock's CableBus platform, which enables these high-capacity, digital subcarriers to communicate via the cable network, can provide services including load shedding control, water monitoring and rationing, supervised handling of security and fire alarms, and premium channel and pay-per-view control as well (see diagram, page 54).

In the company's typical residential application, a terminal in the home is connected to the cable network for two-way data transmission, and is also interconnected with the HomeBus network, which hooks up all energy-using devices, meters, sensors and a display panel, ultimately feeding information from those devices back into the cable network itself.

The cable industry is intent, for now, on exploring the possibilities that relationships with utilities might offer

Another solutions provider, First Pacific Networks (FPN), is currently marketing its PowerView system, a wide area communications platform that provides electric utilities with the ability to reduce costs on power generation, transmission and distribution facilities. In fact, in 1991, one of the largest electric utility holding companies in the United States, Entergy, bought a 10 percent portion of FPN to help finance the product's development.

PowerView requires a robust HFC infrastructure and can utilize either the midsplit or subsplit configuration in the return path, according to Don Marquart, managing director for FPN-Energy Access. The system, which is optimized for either 550 MHz or 750 MHz HFC plant, is built off of FPN's telephony product platform and uses one, 6 MHz-channel in both the upstream and downstream for both energy management and voice services.

The system's key components include a microprocessor-based unit at the residence or business which interfaces to the broadband network, as well as a gateway located in the headend which links into the Public Switched Telephone Network (PSTN) or a private computer network.

Although FPN is in the process of conducting several trials, the newly-competitive quality of the electric utility industry has put a chill on Marquart's ability to comment on them.

Scientific-Atlanta has offered load management products for a number of years, says Matt Oja, vice president of marketing, Control Systems, and though the manufacturer has not announced any specific cable projects, S-A has been laying out an architecture for the past year-and-a-half that it will announce sometime this spring.

And according to information released by CableUCS, the consortium is working with vendors including S-A, Schlumberger Industries, Nortel, Microsoft and W.E. XL to develop "end-to-end" solutions for utility broadband networks.

No deal?

From the information gleaned in their energy information/management trials, cable operators and utilities are attempting to evaluate the potential of these partnerships. Assuming that PG&E's Walnut Creek trial is successful, what type of financial arrangement could TCI look forward to? "Our strategy is that we would only pay for the bandwidth necessary to support energy information services," notes Phillips, "and that is not very much bandwidth."

Then there's the issue of service quality and continuity. A large utility could have as many as 100, 150, or even 200 different cable franchises in the area that it services. And the quality of the broadband cable network varies tremendously from system to system. CableUCS, of course, is the industry's attempt to answer this concern and present a unified front in dealing with the utilities.

The question of ownership could also place a damper on these partnerships. For an electric utility, a communications network is helping to manage customer demand, and is essentially replacing a power plant; therefore, the network must not fail. A high level of anxiety about the robustness of the path would be a compelling reason for a utility to seek ownership of its network capacity, says FPN's Marquart, an issue which has already arisen between telcos and utilities. The telcos have not been pleased by these demands, nor would cable operators be eager to surrender ownership of their network capacity.

Even with these drawbacks in mind, the cable industry is intent, for now, on exploring the possibilities that future relationships with utilities might offer.

And as FPN's Marquart predicts, "I think you will see some strange marriages in the future." CED

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Headend interconnects: Sonet or non-Sonet?

A network cost comparison

By Robert W. Harris and Thomas E. Hall, Broadband Access and Video Networks, Nortel Ltd.

During the past five years, the North American cable TV industry has been deploying, on a relatively wide scale, high-speed linear PCM (pulse code modulation) digital fiber optic transmission equipment. Its primary use has been in regional headend interconnects, broadcast video transport and private video networks. The early success of these digital systems was due in large part to their ability to deliver a high-quality video signal (RS250C medium haul or better) at a reasonable cost. These systems can be configured for complete optical path and terminal redundancy, as well as for drop, add and insert capability.

However, to achieve high quality and low cost, it was necessary for these systems to sacrifice bandwidth (greater than 100 Mbps per video channel) through the use of proprietary and uncompressed signal processing technology. This led to the development of proprietary optical transmission terminals with a typical video payload of 16 channels per wavelength, operating at data rates of 1.5 to 2.5 Gbps. This is not an entirely inadequate option, since these products are typically used within a single system or franchise area with the primary payload being entertainment video, and the principal application for eliminating standalone headends and AML microwave sites.

But, with the improvements over the past several years in video compression techniques, broadcast quality video, audio and BTSC audio can now be processed and formatted within an industry standard DS-3 (45 Mbps) codec at a price competitive with proprietary codecs. Once in a DS-3 format, a signal can be easily placed on a Sonet (Synchronous Optical Network) standard network. In this case, the Sonet network can transport 48 video channels at a rate of 2.4 Gbps when equipped with Sonet transmission products.

A recent survey (see "Return Path," *CED*, February 1995, p.94) shows that the majority of operators are consolidating headends and evaluating methods to cross local franchise boundaries. Most believe that interconnects will not only save money for their system, but will bring in more revenue through the delivery of additional video and non-video services.

However, there is still great uncertainty as to the choice of technology deployment–either Sonet-based or proprietary (non-Sonet) equipment. Both systems can be configured for add/drop/insert applications with self-healing ring architectures. While Sonet systems offer future-proof standard interfaces providing additional telephony service capabilities and software-controlled OAM&P, the proprietary equipment cost is less than that of Sonet-based hardware.

It's suggested here that operators look beyond the head-to-head equipment cost differences and consider the "overall" network cost. This paper examines the cost structures between Sonet and non-Sonet systems used in headend interconnect applications. Considerations include the transmitted channel capacity per fiber and subsequent network fiber usage, the equipment cost per channel and the number and value of any remaining spare

Figure 1a: *Typical non-Sonet digital network*

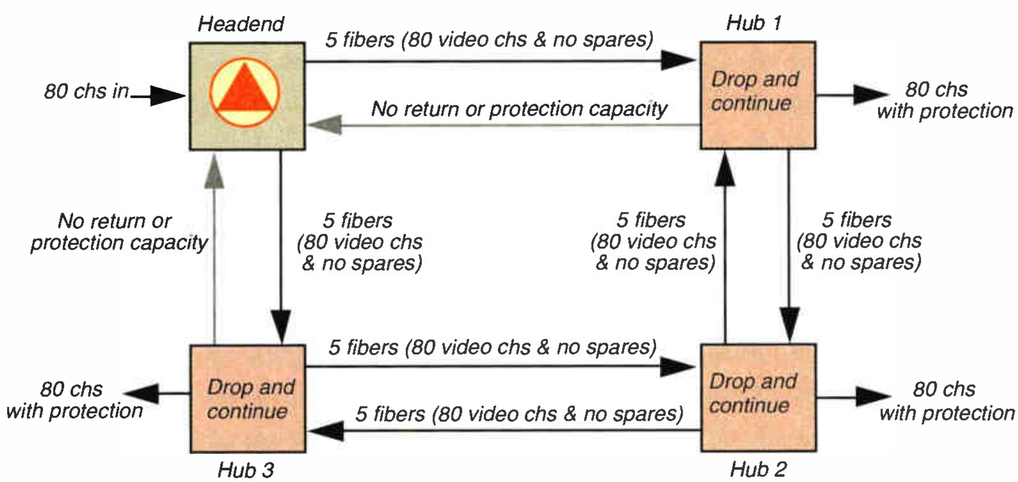


Figure 1b: *Typical Sonet digital network*

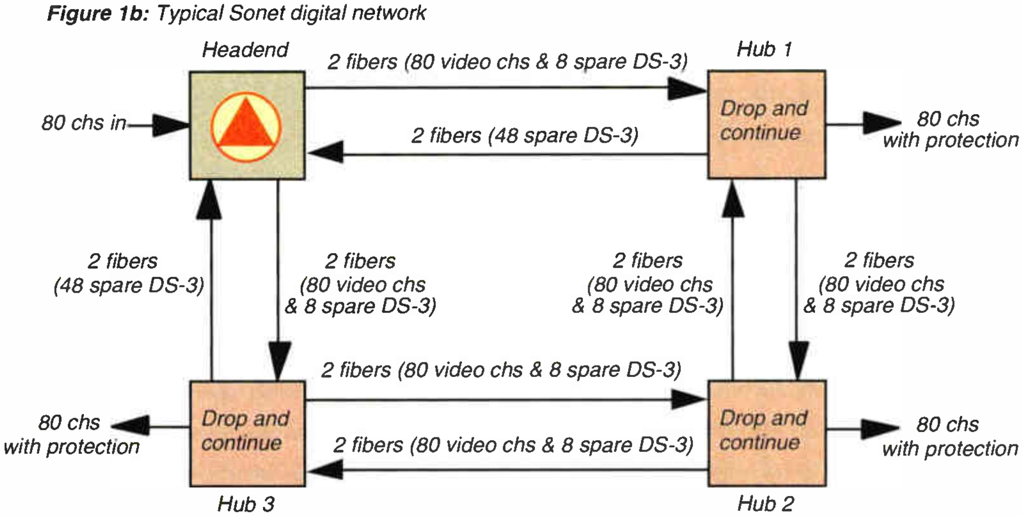
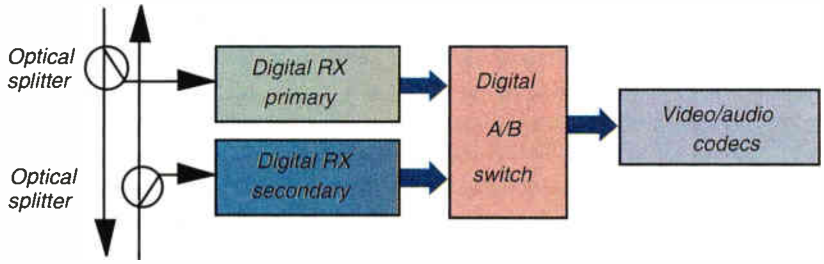


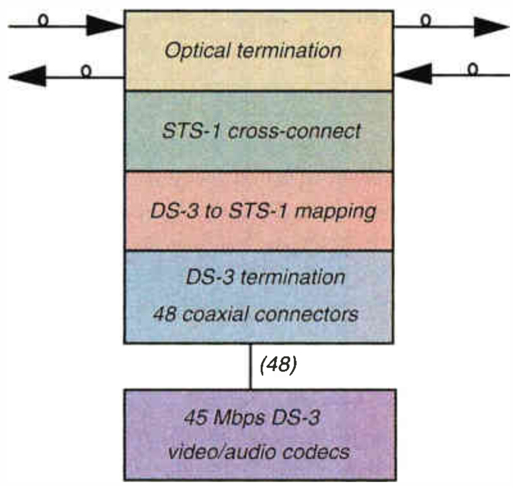
Figure 2: Optical splitting technique



channels used for transporting future video, voice or data services. With these parameters, and using common headend consolidation models, an "overall" network cost for implementing each technology can be determined.

To evenly compare each technology, a common regional headend consolidation application, possible with either Sonet-based or proprietary-based digital systems, is defined. From this application, several models are developed to evaluate the network cost. The first model transports 80 entertainment video channels from a headend in a redundant ring configuration with add/drop capability to three digital receive hub sites. The average distance between each hub site is 10 miles. The second model is identical to the first, except that the average distance between each hub site is extended to 20 miles. The third model evaluates the economic impact of one additional and fully protected video channel between hub 1 and the headend. This channel could represent a local station or an ad insertion pick-up. Finally, the revenue potential capacity of the Sonet-based network through leasing spare DS-3 channels is briefly examined.

Figure 3: Sonet hub equipment configuration



Model 1

Typical non-Sonet and Sonet-based systems are shown in Figures 1a and 1b, respectively. Because of the relatively short distances between each hub in model 1 (10 miles), the non-Sonet system can take advantage of optical coupling in order to distribute the optical power (hence the cost) of the transmitters among the digital receivers in hub sites 1 and 3. This technique is shown in Figure 2. While this has the effect of lowering the overall equipment cost of the non-Sonet system, since additional transmitters are not required to regenerate the digital signals, this does eliminate the ability to add channels at these sites. For the Sonet-based network, the equipment configuration is such that the optical signal is received, then optically re-transmitted at each hub site, allowing full drop and insert at each location (see Figure 3).

While both networks provide full optical path redundancy, two key differences are evident. First, the Sonet system uses a total of 16 fibers (four between each site), whereas the non-Sonet system uses a total of 30 fibers (either five or 10 fibers between each site). Second, while the Sonet system has a significant number of spare channels, the non-Sonet system has no spare channel capacity.

Model 2

Now the distance between each hub is extended to 20 miles. With the increase in distance between each hub in model 2, the non-Sonet system now must use optical regeneration in each of the hub sites. The equipment configuration for this technique is shown in Figure 4. While this does not increase the fiber usage, it does increase the equipment cost of the non-Sonet system relative to model 1, since additional optical transmitter and digital switching devices must be added.

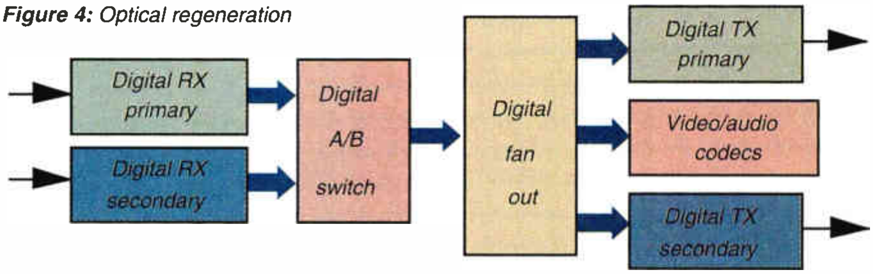
In both models 1 and 2, the Sonet-based equipment cost has remained constant. There has been no need to consider various equipment configuration options. However, in model 1, the Sonet-based video transport system equipment costs are about 31 percent more than non-Sonet based systems. In model 2, while the PCM system equipment cost increased because of added hardware, the Sonet equipment cost is still about 19 percent higher. However, one must look beyond the direct electronics cost differences and consider the overall cost of the network. This includes the installed costs of the fiber as well as placing a value on the spare channel capacity.

Fiber costs

Figure 5 shows the installed fiber cost based on aerial installation of self-supporting cable for various fiber bundle sizes. Each fiber in the bundle has associated with it a particular value. For example, each fiber in a 48-fiber bundle installed over an 80-mile distance (such as four links at 20 miles per link) is worth about $22,500 in materials and installation.

Figure 6 shows the fiber usage requirements of both the Sonet and non-Sonet systems for both models 1 and 2. The Sonet system uses four fibers consistently between each hub for a total of 16 fibers, while the non-Sonet system utilizes a varying number of fibers between each site for a total of 30 fibers (47 percent more). For model 1, 10 miles between each hub site yields 40 route miles. So, from Figure 5 we find that for a 48-fiber bundle each fiber is valued at $11,546.

Figure 4: Optical regeneration



For model 2 and 20 miles between each hub, the value for each fiber in a 48-fiber bundle is $22,484.

Value of spare channels

A careful inspection of Figure 1b reveals the number of spare channels available on the Sonet-based network after providing 80 channels of video. These channels are labeled as 45 Mbps DS-3 channels which could also be used to transport multiples of DS-0 and/or DS-1 signaling with the properly added multiplexers. The main point is that these channels represent a significant amount of additional bandwidth already in place and paid for. If new services are added, there is no need for additional optical terminals or fibers. With the non-Sonet system in models 1 and 2, the transport capacity is full, and the addition of new services would require the purchase of new optical components and the activation of dark fibers.

We can, therefore, place a value on the spare channel capacity. This value is rather ambiguous because of the type of payload being delivered, i.e., telephony, data, entertainment video, interactive video, etc. We establish the spare channel value in terms of bandwidth capacity. The spare channel value is then determined by pricing out the network with only the transmit and receive optics and associated A/B switches for a non-Sonet system. This network price yields a bandwidth-only capability and, when divided by the number of high-speed channels transported, provides the value of a spare channel on the Sonet system. An estimate of the optical transport section cost for a single high-speed channel of the non-Sonet system in this application is $2,930.

Comparison of total network cost

The overall network cost can now be determined more accurately as the fiber costs and the value of the spare channel capacity are included. Figure 7 shows the network cost comparison for model 1. The equipment cost difference is about $379,000 in favor of the non-Sonet system. But, the cost penalty for using 47 percent more fibers is $161,000. Further, the spare channel capacity value of the Sonet system is $421,900. These two values combined offset the additional Sonet equipment cost by about $203,900.

Figure 8 shows the network cost comparison for model 2. The equipment cost difference is now about $250,000 because additional hardware was necessary for the non-Sonet system (note that the Sonet network cost has not changed). Further, the cost penalty for using 47 percent more fibers over the additional distance has increased to $315,000. Couple this with the spare channel capacity value, and the Sonet-based "overall network cost" is actually $486,900 less than a non-Sonet solution.

Model 3

Model 3 is an application where one additional video channel is added to the network of model 2 from hub 1 and sent back to the headend fully protected. The video channel added could represent a local broadcast station or an ad insertion channel. The Sonet-based network, with its considerable amount of spare channel capacity, does not require the activation of dark fiber, nor the purchase of new optical terminals. However, since the non-Sonet based system was already at maximum capacity, additional optical equipment is needed, and dark fibers must be activated. The non-Sonet system requires the activation of four additional fibers–one fiber between hub 1 and

Figure 5: *Installed cost of aerial fiber cable*

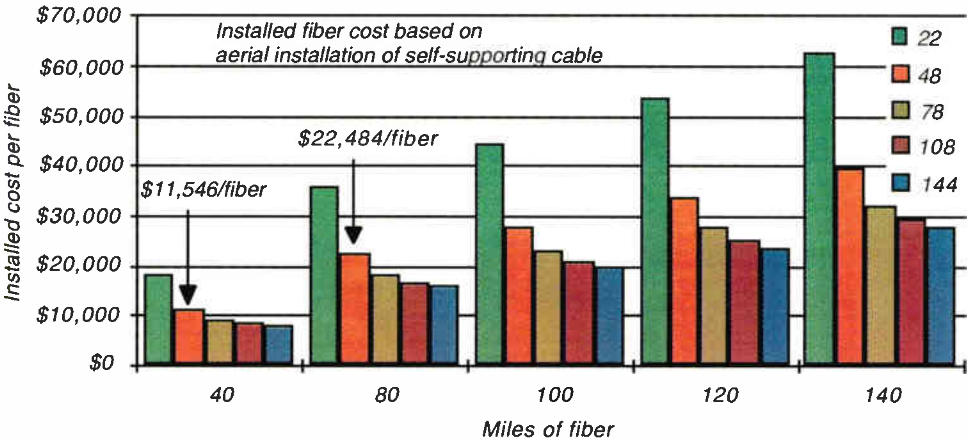


Figure 6: *Total fibers used for either model 1 or model 2*

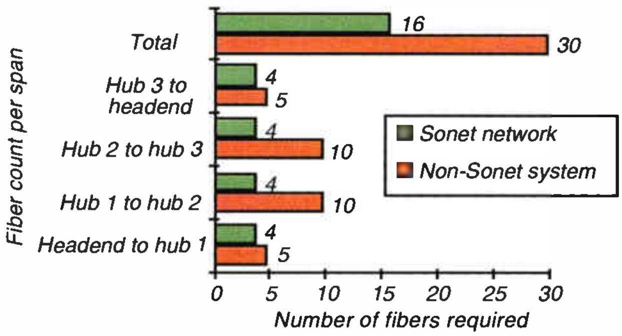


Figure 7: *Network cost comparison for model 1*

	Non-Sonet	Sonet	Delta
Equipment cost (10 mile links)	x'	c	$379,000
Total # of fibers required	30	16	14
Total fiber cost	$345,000	$184,000	($161,000)
Spare channel capacity	0	144	144
Total spare channel value	0	$421,900	($421,900)
	Total cost savings with Sonet		($203,900)

Figure 8: *Network cost comparison for model 2*

	Non-Sonet	Sonet	Delta
Equipment cost (20 mile links)	x"	c	$250,000
Total # of fibers required	30	16	14
Total fiber cost	$675,000	$360,000	($315,000)
Spare channel capacity	0	144	144
Total spare channel value	0	$421,900	($421,900)
	Total cost savings with Sonet		($486,900)

Figure 9: *Network cost comparison for model 3 when adding one fully protected video channel*

	Non-Sonet	Sonet	Delta
Additional equipment cost	y	k	$45,000
Total # of additional fibers	4	0	4
Total additional fiber cost	$90,000	$0	($90,000)
	Total cost savings with Sonet		($135,900)

the headend, and three additional fibers between hubs 1, 2, 3 and the headend for route protection. The overall network cost comparison evaluating the economic impact of adding just one channel is shown in Figure 9.

As mentioned previously, the Sonet system provides spare channel capacity that can be used to generate additional revenue. One can evaluate this revenue potential per the tariffed DS-3 rates of $420/mile/month used by the telephone companies

For example, using 32 bidirectional DS-3s over a link distance of 20 miles would result in an additional revenue of $268,800 per month. This potential revenue can be of significant value since only the Sonet standard system can provide this capability without having to resort to costly and awkward gateway devices. Hence, this capability must also be considered as part of the overall network cost.

Conclusions

While there have been significant reductions in Sonet equipment hardware costs for headend interconnect applications in recent months, the costs can still be more than 19 percent higher than non-Sonet methods for interconnecting headends. However, evaluating the "overall" network cost in typical network models reveals a more appropriate and complete total cost structure. The overall cost is determined by considering both the fiber cost and spare channel capacity value between the two methods.

Further, one should also consider the revenue generating potential of the Sonet network in the overall cost structure. In models 1 and 2, the Sonet equipment cost remained constant regardless of network configuration and distance between hub sites. In each model, the Sonet system used at least 47 percent fewer fibers and provided a substantial amount more of spare channel capacity (telephony compatible) than the non-Sonet approach.

All of this results in a Sonet network with "overall" lower costs than non-Sonet systems. Imple-menting Sonet into the cable TV network is therefore cost competitive with alternative non-Sonet solutions.

An added benefit, and inherent within a Sonet-based network, is the centralization of operations, administration, maintenance and provisioning (OAM&P). This eliminates the need for a costly and complex overlay communications network to support remote operations.

As the cable TV systems of today evolve into the telecommunications networks of tomorrow, the delivery of a multitude of bi-directional services will place new demands on the equipment used for interconnecting headends. Further, the interconnections will extend well beyond the local serving and franchise areas of these systems. Hence, common standard interfaces are a must if multiple cable TV systems are to function as a single network. CED

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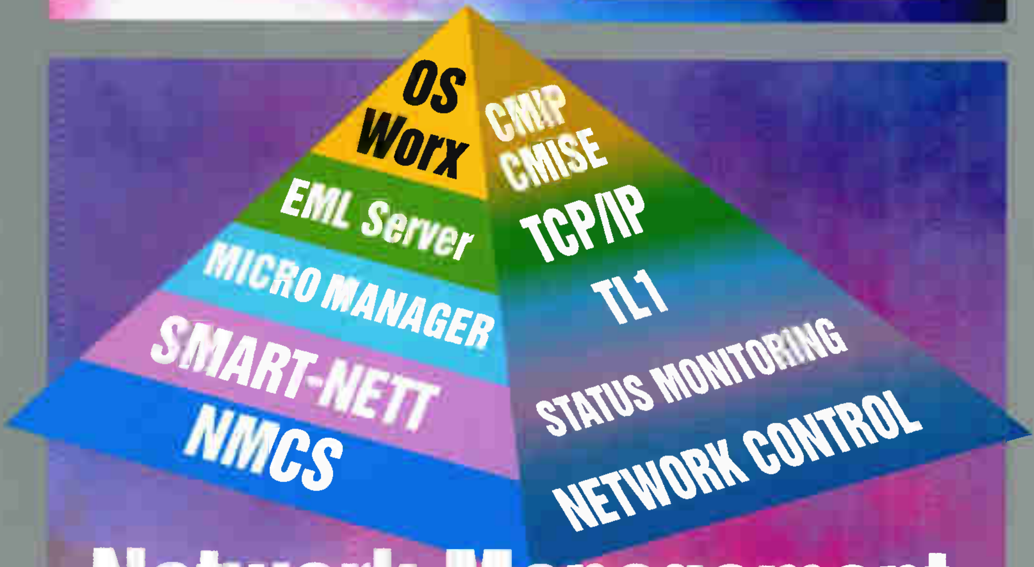

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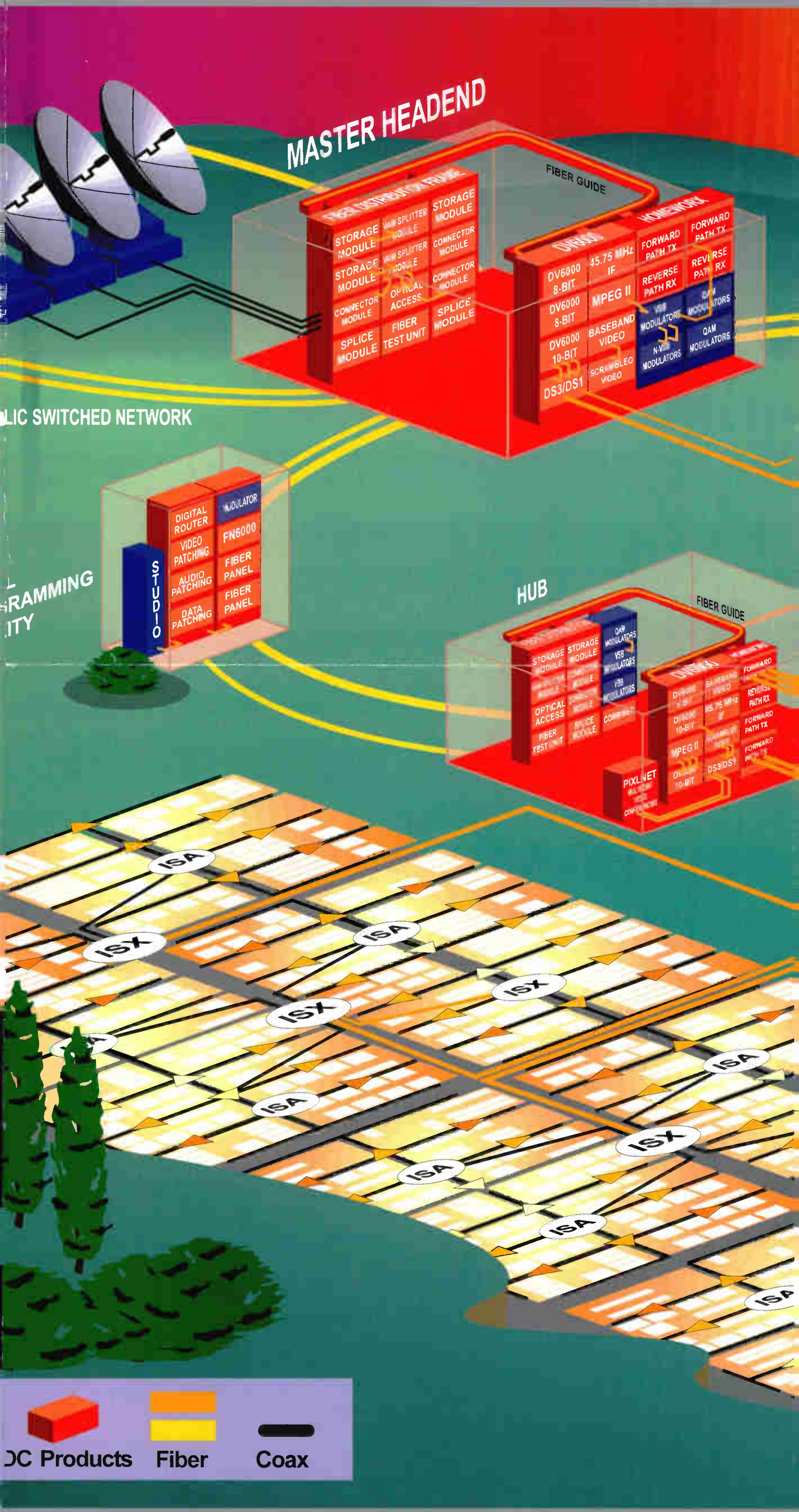

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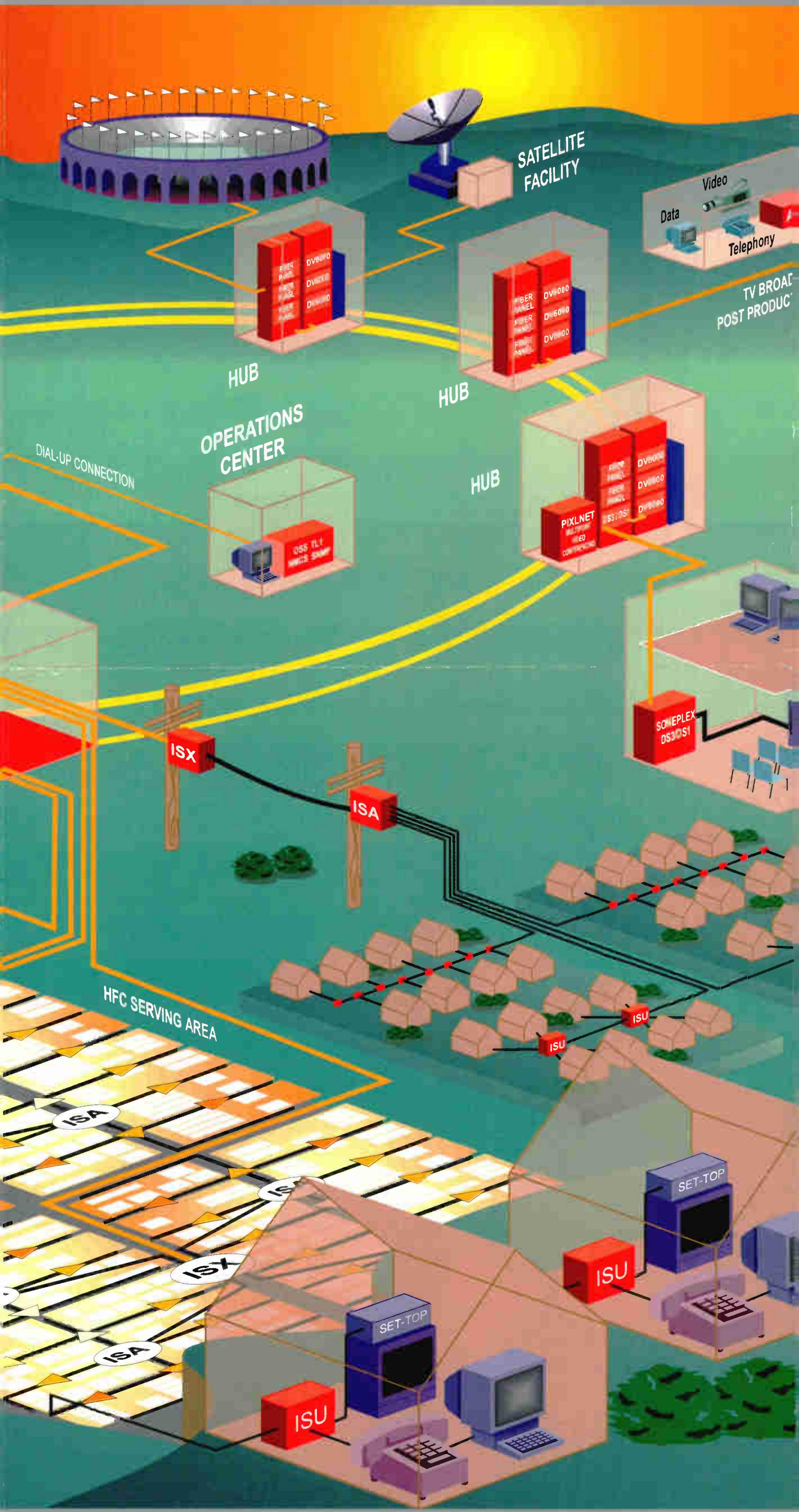

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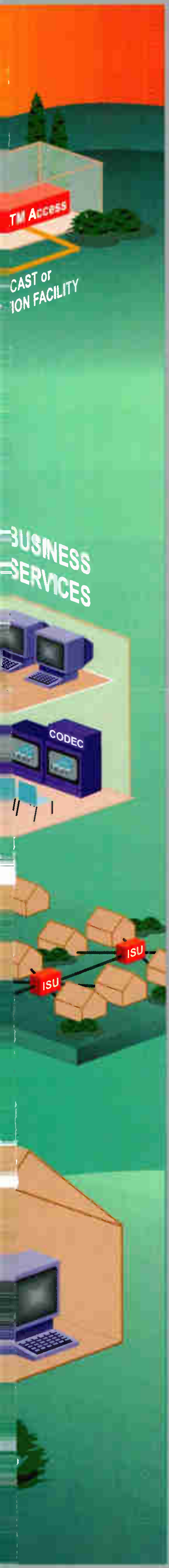

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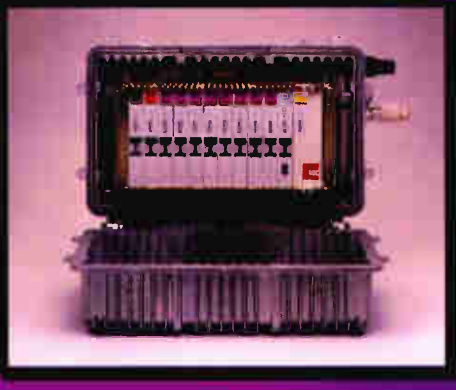

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An OSS model with staged deployment

Architectural building blocks

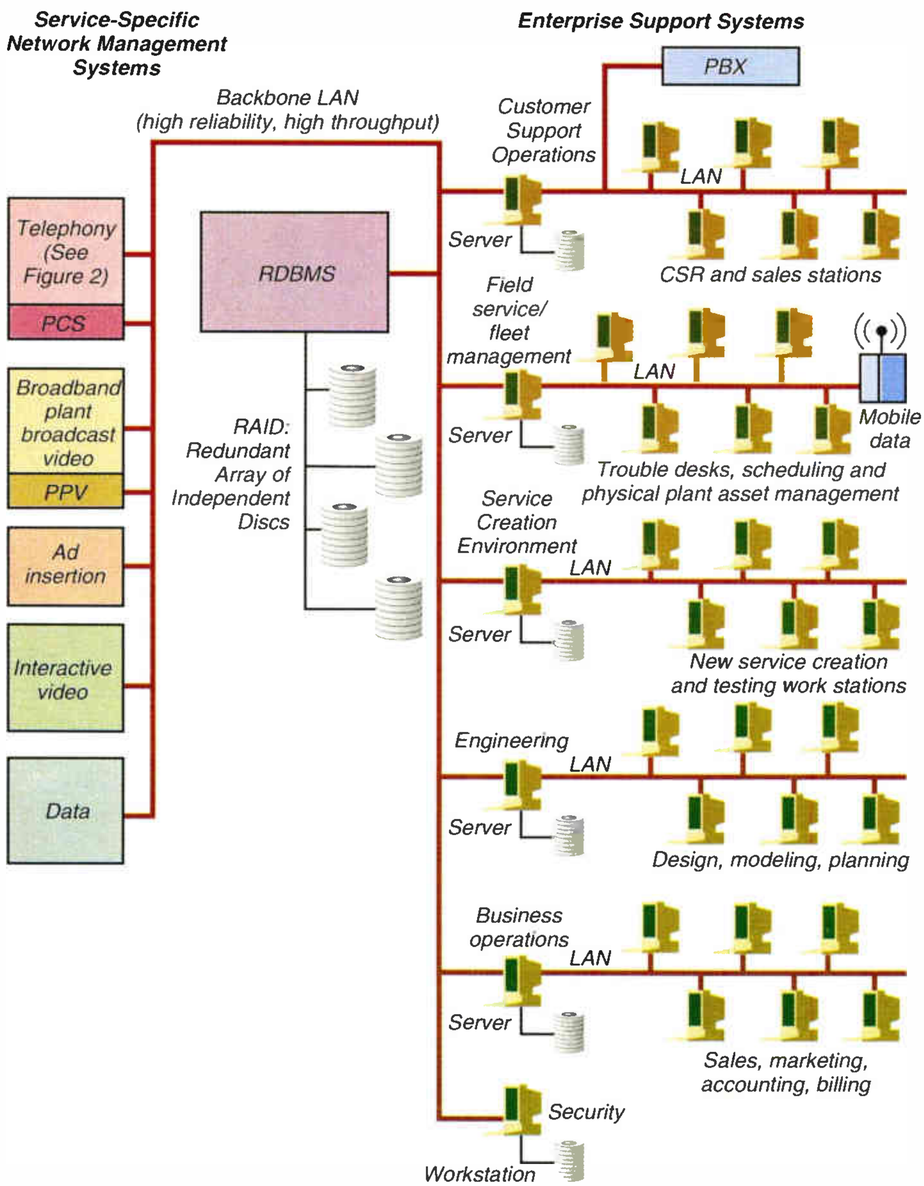
By Steven Wright, consultant

***Editor's Note:** This is the final part of a three-article series on OSSs.*

The competitive telecommunications ball has begun. You know what to look for in dance partners for different dances, so let's get out on the dance floor and have some fun!

In part one of this series, an approach to defining processes was outlined as the first step in developing a complete strategy for operational support systems. In part two, some of the important tools available in the software industry were shown. Now, an overall structure or architecture of operational support systems (OSSs) is described in terms of basic building blocks. The deployment of this architecture can be staged so that major cost decisions are made only as they are needed. The architecture assumes a few things about the processes, but for the most part, is independent of them.

Figure 1: Operational Support Systems



The distributed support system model

This model makes a distinction between computer systems necessary to support the hardware and software delivering a specific service (such as telephony, pay-per-view, etc.), or so-called "service-specific network management systems" (SSNMSs), and systems which support organizational functions shared by all or most services, or "enterprise support systems" (ESSs). The model is depicted in Figure 1. It also separates out each SSNMS, rather than attempting to create a single do-all network management (NM) system.

The various OSS elements shown are linked together physically via a network which is separate from the connection or payload network. This backbone local area network carries only support system and management message traffic. Each OSS subsystem is tied into the primary backbone network, and most traffic will be for communicating with the database.

In general, little communication occurs directly between two subsystems; therefore, subsystems always access the most current information that is stored in this single distributed database system. There is no ripple effect of necessary changes throughout the other subsystems (due to their interconnection) arising from changes to a particular subsystem.

In the same way that a MIB is used for network management, other information bases are also resident in the database and are used as central "clearinghouses" for information by the various OSS subsystems. The database system structure will probably be best implemented in a distributed manner. It still looks and acts like a single database, but the data and management system will actually be resident in part on many different servers, thus increasing efficiency and responsiveness.

Some view OSS architecture with the database as the center of OSS strategy. This model does not apply here, as event analysis and automated action initiation activities must be supported. In this model, "engines" are imple-


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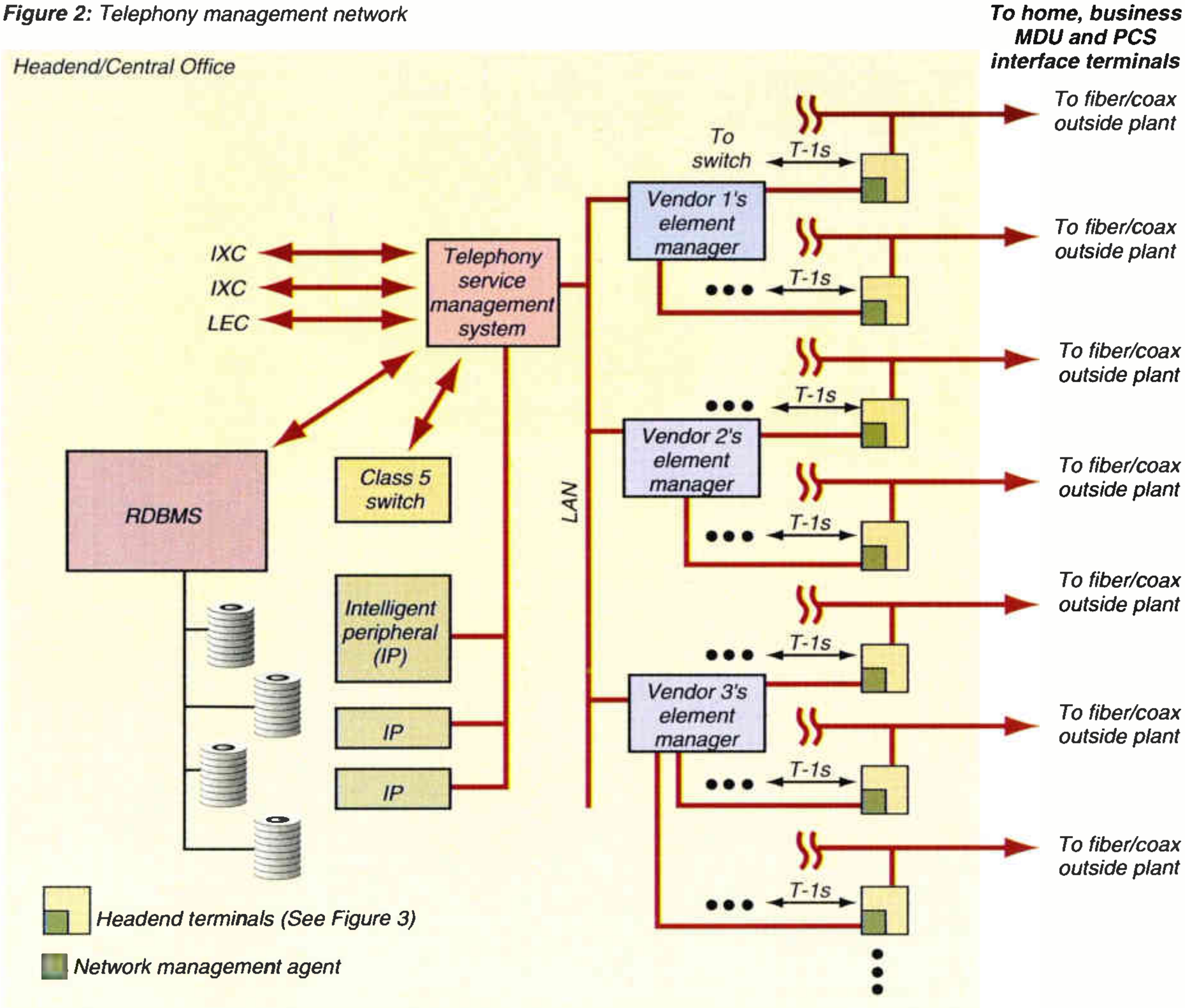
Figure 2: Telephony management network



mented to do that, and one or many are present in each SSNMS. They are a core part of the strategy, along with the database management system.

Many views of network management also attempt to centralize the management of everything by a single network management system. Centralization should only be pursued when there are clear benefits, and in the case of a broadband network operator offering many different services, there is relatively little to be gained by a single manager strategy at the SSNMS level.

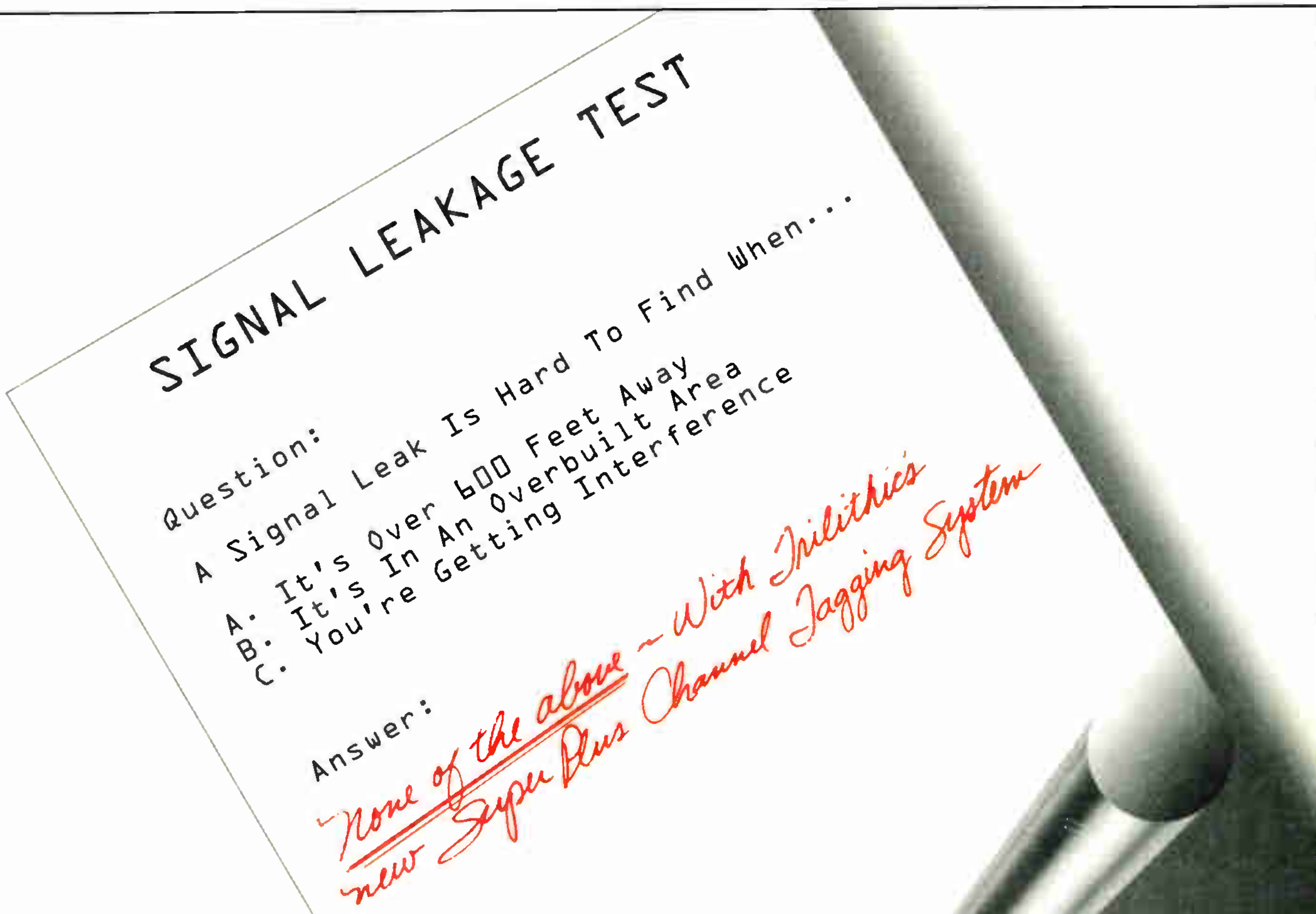
Practical aspects of deploying systems make such attempts difficult. Usually, there will be a different product manager and department responsible for each major type of service or product. Each has a business plan and a budget for offering their service, and will not want to be compromised by waiting for another product line to finalize its manager configuration.

The architecture of the management systems should not end up driving the processes

Timing of each service offering will not be coordinated perfectly, either, because of market conditions and other factors. Independence between the SSNMSs also makes the overall system more robust, so if there is a problem with the management platform for one service, the others will not be critically affected. Independence also fits the distributed management benefit of forcing cost/benefit decisions into the budget for the person responsible for requesting any system function which impacts costs.

The enterprise side of the diagram shows one view of how various organizational tasks could be broken down into logical work groups that can each be supported by an ESS. There are many different ways to segment these tasks, and a particular implementation of this model will depend on how an individual operator defines his processes. The key aspect of this architecture is that there are different client/server systems servicing some grouping of people with related tasks, and each work group server is linked to the OSS backbone. The primary purpose of the link, as is the case with SSNMSs, is to write to and read from the common database.

One very critical area for work group systems is customer service operations. Advances in computer/telephony integration, interactive voice responses systems (IVR), and PBX interconnections now allow a powerful cus-



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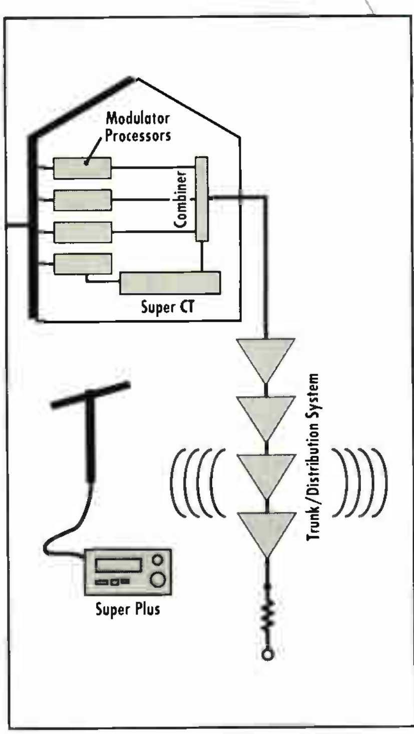

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While it is not always apparent when talking about processes, the architecture of the management systems should not end up driving the processes. For example, a process of establishing service for a customer who calls a CSR and requests service will require support from several parts of the model shown in Figure 1. It is important, (and often difficult), to distinguish between process definitions and technology support systems for those processes. The more rigorously the processes are defined, the easier the task of keeping track of a process definition and a specific technology implementation of systems to support that and other processes.

The importance of this model, at the level of detail shown in Figure 1, is that it assumes little about the supported processes. Only some general and mostly practical considerations form the basis of the model. A simple fact in the telecommunications industry is that while many people can speculate about what a network will be in a few years, it is becoming increasingly unlikely that anyone can predict with accuracy what the actual product mix, and thus network configuration, and thus network management/OSS picture will look like. The basic model must be simple and flexible enough to grow and evolve with the constantly changing consumer market for broadband services.

Some key features of this model are:

✔ Independent development and implementation of network management systems for different service offerings;

✔ A method to ensure consistent, accurate and timely information to all systems;

✔ Distributed database and management functionality;

✔ Strict information system budget accountability by service offering or product management area;

✔ Interconnection of all systems while allowing growth in volume of management transactions and growth in features;

The event engine is aware of the status of the entire network as it changes in real-time

✔ Backward compatibility with essential legacy systems is easily deployed with the addition of a mediation function implemented in the appropriate SSNMS or enterprise support system server.

Service-specific network management

Each SSNMS is separate because the timing and budget approval will in all likelihood, be different for each service. Technology will progress at different rates, and consumer demand will evolve differently for different services. It is therefore a practical consideration that each service have a specific dedicated service network management system that can evolve separately.

All requirements for supporting a specific service that do not clearly fall into the category of one of the enterprise support systems will be met by the SSNMS. Obvious examples of areas covered in part by the SSNMS are the classic definitions of fault, configuration, accounting, performance and security.

Each of these areas, when defined as a process, is also supported by various enterprise support systems. So when the question is asked, "What does the SSNMS do?," the answer is not a clear-cut translation from a complete category of process requirements. Some aspects, for example, of the fault management process are covered by the SSNMS, while some are covered by customer support operations, and others by field service/fleet management, (as defined in this straw man model of enterprise work groups).

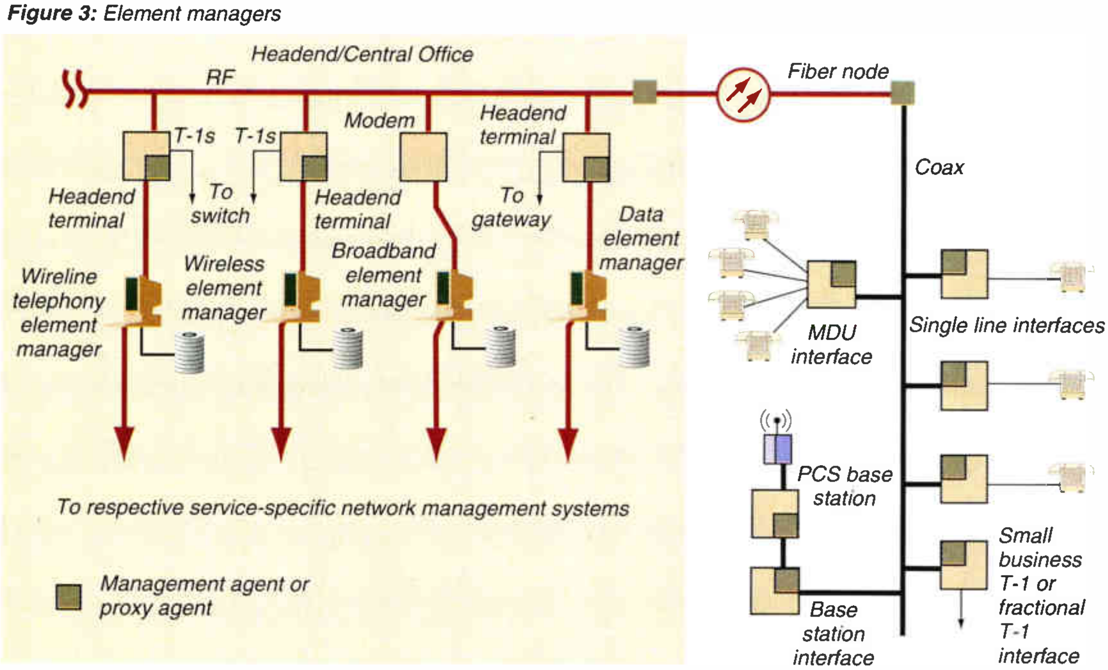
The way to ensure the success of this model is to create process diagrams or descriptions, and then assign various subsystems (SSNMSs or enterprise support systems) to perform each of the different parts. The process analysis is critical to ensure that the desired end result actually happens.

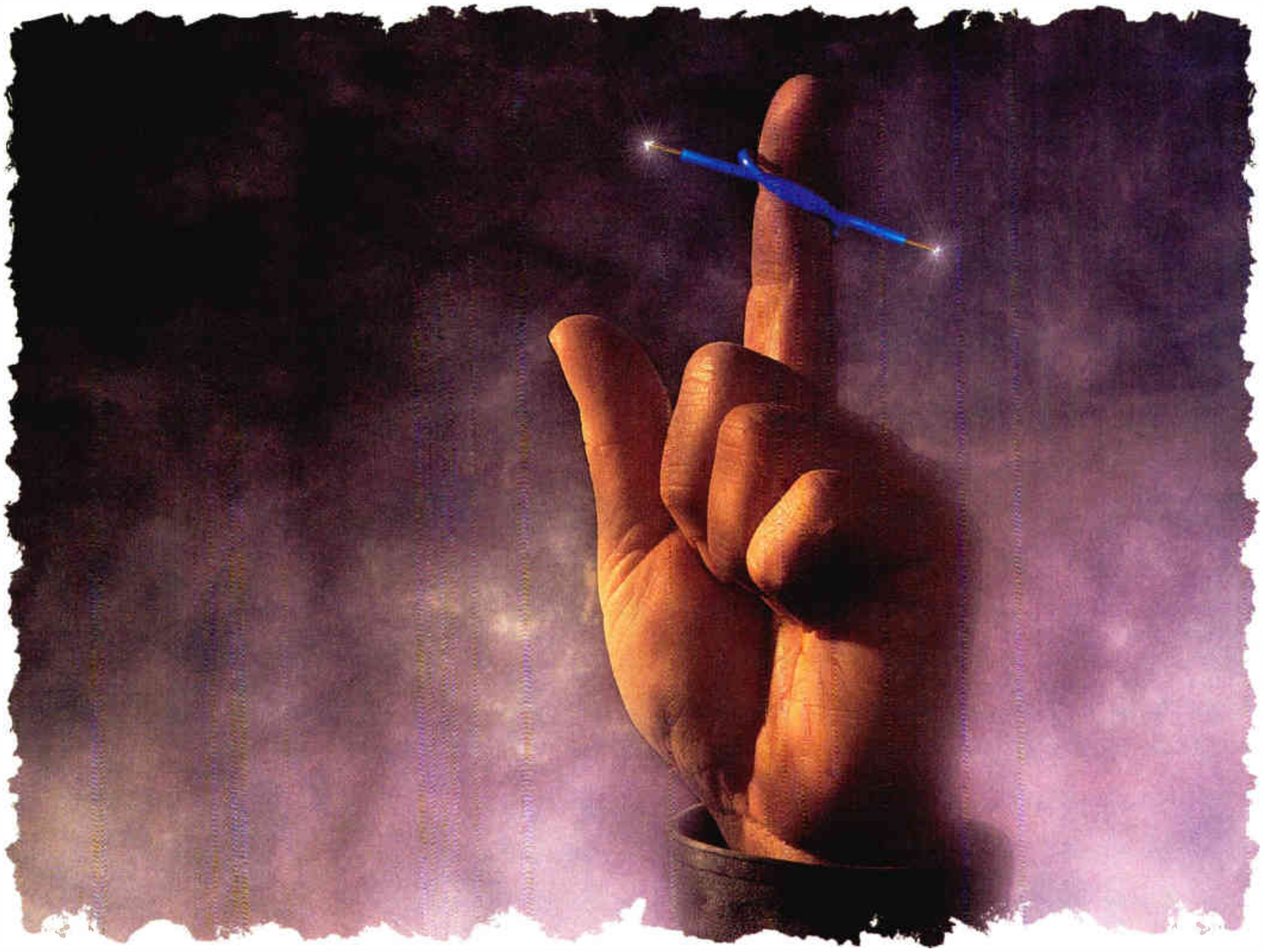
SSNMS: A telephony example

In Figure 2, an example of a telephony service management system is shown. It is not the intent of this article to define the telephony service management system. The intent is to communicate the idea of what a service specific management system might look like.

At the core is an event engine that does things like take in information obtained by polling, or from spontaneous reports sent by network elements based upon predefined events which occurred at the element, or operator inputs. It then interprets the information, may issue notifications to an operator's terminal and other human interfaces, and may take actions. The event engine is therefore cognizant or aware of the status of the entire network as it changes in real-time. The actual information about the status of the network resides in the database, to which the

Figure 3: *Element managers*





SSNMS is constantly writing to and reading from.

The SSNMS has direct or indirect connections to every intelligent device involved in the service or services under its purview. In this telephony example, all connections shown are part of an overlay network dedicated to management message traffic.

The system is connected to interexchange carriers (IXCs) for things like electronic bonding for flow-through provisioning or trouble management; to LECs for the same; to the database system; to the class 5 switch; to the intelligent peripherals (computer systems that provide services like voice mail); and to the element managers for the digital loop carrier-like systems that provide telephony over coax.

As shown in Figure 2, there is a headend/CO terminal (typically) for each fiber node. It is an intelligent device that makes the connections with the network interface units at the customer's premises. It will also provide for software to run on it that implements NM functions. This software is called an agent, or proxy agent, depending on standards compliance.

Each element manager will likely manage several HE/CO terminals. The number managed will depend on its processor capabilities and volume of management message traffic that it must handle in normal and problem situations. Different vendors' systems may be present in the network, so each element manager will most likely be designed and provided by that vendor.

Element management

In Figure 3, a third level of detail is presented. There are different HE/CO terminals for some of the types of service offered over the broadband plant. Shown are wireline and wireless, the broadband plant network management system modem, and data system terminals and element managers. Some of the various customer premises and outside plant interface devices are also indicated. Also shown are network management agents in these interface devices.

Not shown are other potential independent systems, like impulse PPV, or a bandwidth manager that communicates with each terminal and ensures efficient prioritized allocation of bandwidth.

OSS evolution

For each service there is a timetable for deployment. The defined process will gradually increase in complexity as the service deployment progresses. The timetable will be based upon technology, marketing, and legal and regulatory considerations. The following is one scenario for telephony deployment.

The OSS requirements are outlined, from which it can be seen that there is an evolution to the OSS environment that tracks with the evolution of the network.

Phase I

Process requirements:

✔ Prove two-way plant capability

✔ Establish, maintain and terminate a connection from customer premises interface to HE/CO terminal.

OSS requirements:

✔ Element manager

✔ Terminal and interface agents.

Phase II

Process requirements:

✔ Prove connection to the public switched network

✔ Prove billing

✔ Prove security.

Additional OSS requirements:

✔ Implementation of the OSS backbone LAN

✔ Billing module to business operations ESS (prototype)

✔ Basic RDBMS on-line (on low-cost hardware platform) with customer account area defined and billing data collection and security areas defined

✔ Security ESS, with interface unit authentication and authorization modules (prototype)

✔ Temporary SSNMS with minimum functionality and on same platform as element manager.

Phase III

Process requirements:

✔ Trials with friendly customers (employees) test marketing trial functionality

✔ Test customer support operations processes

✔ Push the technical limits of system.

Additional OSS requirements:

✔ SSNMS with core engine platform on separate hardware platform (low-cost), with fault, configuration, security modules (all in prototype form)

✔ Customer support operations ESS prototype.

Phase IV

Process requirements:

✔ Marketing trial to test features, form, fit, function of interface unit and basic offered services

✔ Customer support process testing.

Additional OSS requirements:

✔ SSNMS with first version fault, configuration, performance, security modules

✔ Customer support ESS first version with all essential functions

✔ Business ops ESS add sales, marketing and accounting modules (prototypes)

✔ Engineering ESS (prototype)

✔ Field service/fleet management ESS (prototype).

Phase V

Process requirements:

✔ Limited deployment to specific targeted customers by geography or demographics.

Additional OSS requirements:

✔ SSNMS to fault-tolerant hardware platform

✔ RDBMS to fault-tolerant hardware platform and Redundant Array of Independent Discs

✔ All SSNMS and ESS modules on first or later versions.

Phase VI

Process requirements:

✔ Systemwide deployment of basic services

✔ Develop and test methods to introduce advanced telephony features.

Additional OSS requirements:

✔ Service creation environment (SCE) prototype.

Phase VII

Process requirements:

✔ Enhanced features deployment.

Additional OSS requirements:

✔ SCE deployment version.

Summary

The model presented here represents assumptions about one method to implement service. The important thing to gain from this presentation is the approach and methodology, as the particular circumstances of an actual system will certainly impose requirements not covered here.

It has been shown how to approach definition of software support system requirements through rigorous attention to the process, and not the technology.

Important new software technologies that will support the defined processes better than previously possible were also examined. Finally, a generic model was proposed which utilizes these new technologies in a way that is as independent of a specific process as possible, thus ensuring maximum future flexibility for changes and growth.

A more specific implementation of the model, a phased approach to the deployment of specific technologies, was shown to provide the opportunity for incremental investment as well as the development of organizational expertise. CED

Harnessing the power of the PC

Turning cable plant into a high-speed LAN

By LANcity staff

***Editor's note:** This article is part two of a two-part series. Part one appeared in the April issue of* CED.

A new media access control (MAC) protocol has been designed from the ground up to account for the unique requirements of a cable television network environment. It is optimized to operate over the cable TV infrastructure over large metropolitan distances. It supports 10 Mbps data transfer rates on the forward and reverse channels within industry standard frequency agile 6 MHz channels at distances up to 160 miles.

Other protocols have been developed for data communication over cable TV and have in fact been standardized by the IEEE, so why not use them? The answer is that they all have limitations that prevent them from being widely deployed on a citywide scale in commercial subsplit cable plants. The IEEE 802.14 committee has been chartered to resolve these issues and provide a protocol that resolves the issues and can be economically deployed.

Ethernet over broadband is an available protocol but is limited in the area of coverage, its performance under heavy data loads, and its ability to provide the different types of services required, such as multimedia. Token bus is another protocol, and though not as limited in its area of coverage, it is sensitive to connections being powered on and off and limited in the types of services it can effectively provide.

This new protocol supports two modes of transmission access to the cable TV coax for the different types of connected applications: contention- and reservation-based. Contention access is similar to Ethernet by providing low latencies under light loads by giving immediate access to the network. It is, however, subject to collisions and degradation of performance as data traffic increases. The protocol has the ability to provide a reservation mechanism for sustained, collision-free access to the network during high traffic conditions. The protocol supports a simultaneous mix of both modes and dynamically switches between them as needed to optimize network data bandwidth efficiency.

The downfall of many multidrop access protocols is the degradation in performance as network distances increase, resulting in large delays. The protocol gets around this by having each node determine its round-trip propagation delay through the network and synchronizing its transmissions precisely to periodic timing signals on the network. These timing signals are provided by any node designated as the pacer, and the pacer election process is done automatically as part of the protocol. Thus, multiple nodes can have transmitted packets on the network at the same time, but each transmit is timed such that they are non-overlapping. This keeps the media pipe full and the channel utilization and efficiency high.

Figure 5 shows how time is represented and maintained on such a network. Time division multiplexed slots are available for data transmission with fixed period timing delineators (block synch) providing the timing references that keep order.

The protocol fits well into the traffic patterns that are common for this type of environment. Constant bit rate with no jitter for voice applications, variable bit rate with limited jitter for multimedia applications, and available bit rate for basic data services are supported within the same channel. It is also transparent to all network operating systems and transport mechanisms, such as TCP/IP and IPX, and can therefore coexist with applications written on top of them.

Internetworking

An internet is composed of two or more networks interconnected via a communications infrastructure. See Figure 6. The interconnected networks are often structured as a hierarchy for ease of understanding and operation.

Prime examples of this concept are the Internet, major corporate networks, telco networks and the proposed National Information Infrastructure (NII). Networks in this hierarchy are composed of cooperating host computers and the network infrastructure which provides the communications services between them.

The most well-known example of a network is a local area network, or LAN. In this network the hosts/users are usually PCs, workstations and mini computers. The communications infrastructure is commonly based on:

✔ A physical cable plant such as Ethernet or Token Ring

✔ A protocol stack such as TCP/IP, or IPX providing communications services

✔ A network operating system such as Novell or LAN Manager providing shared applications.

University, corporation and school-based high-speed LANs have changed the mode of operation for these organizations. Services such as printer sharing, access to file servers, peer-to-peer connectivity, e-mail, interactive tools, distributed CAD/CAM, Internet access, extended LANs, video conferencing and others have contributed to a major improvement in productivity for these organizations.

Thus, in considering the development of an internetwork based on an HFC system, it must provide a reliable and manageable communications infrastructure that is easily scalable

***Figure 5:** Each node synchronizes to the block synchronization packets*

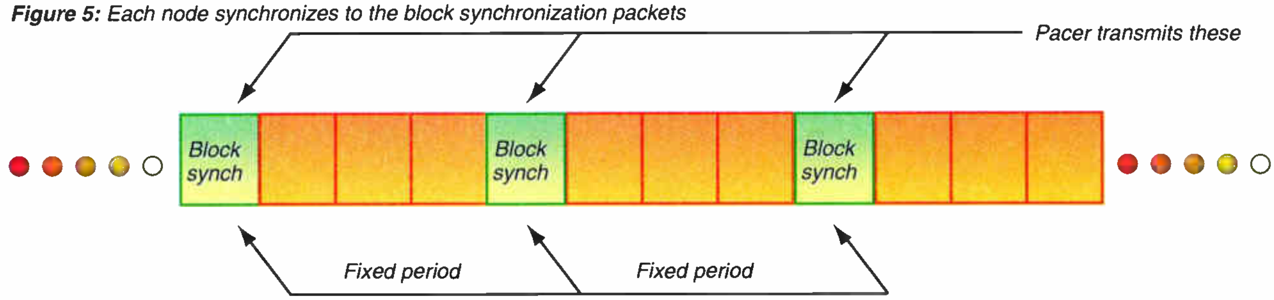


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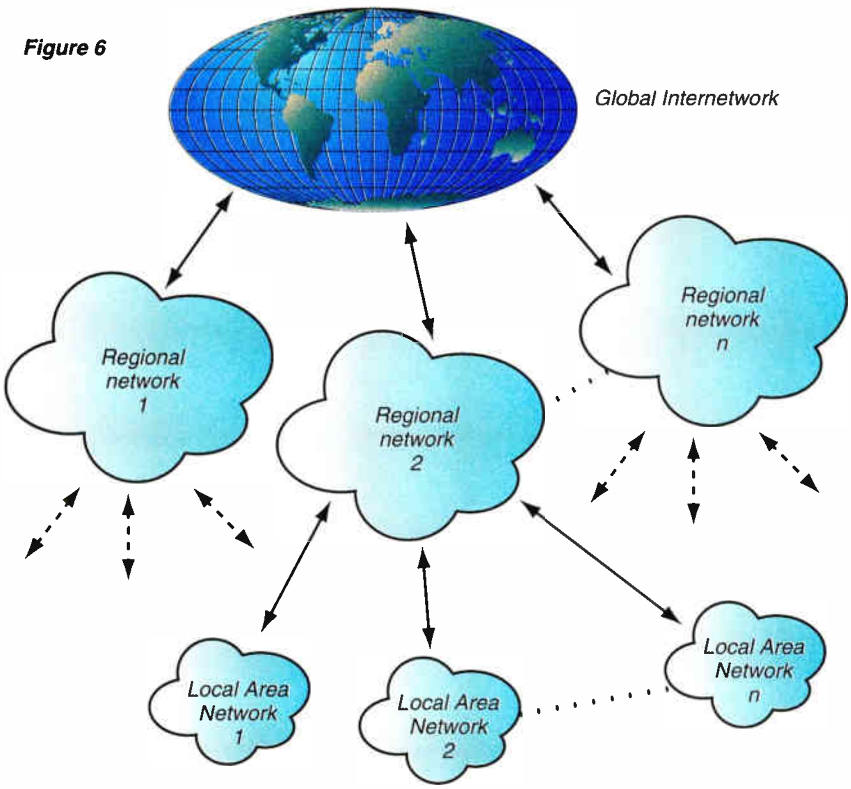
Figure 6



and supports multiple applications with differing communications needs.

Internetworks have been constructed based on many paradigms. In general, however, the mechanism used to provide communications between systems on the HFC network is based on either bridging, routing or switching.

Bridges are the simplest devices used to interconnect LANs. They operate at the MAC layer and are independent of the OSI model higher layer protocols used. Thus, they can be used to forward multiple protocols, yet remain small and simple to configure. The principal difficulties with bridges are that they do not scale well as they must remember individual host addresses to perform filtering and allow only flat (non-hierarchical) networks. They do not provide the more sophisticated management and security features available from routers and switches.

Routers operate at the network layer, supporting hierarchical network structures and much better scaling (routers remember the location of networks, not individual host addresses). The primary disadvantage of routers is that they are protocol dependent and are much more complex than bridges in both internal software and in configuration needs. A router can provide significant added security over a bridge and is frequently used as a firewall within a network.

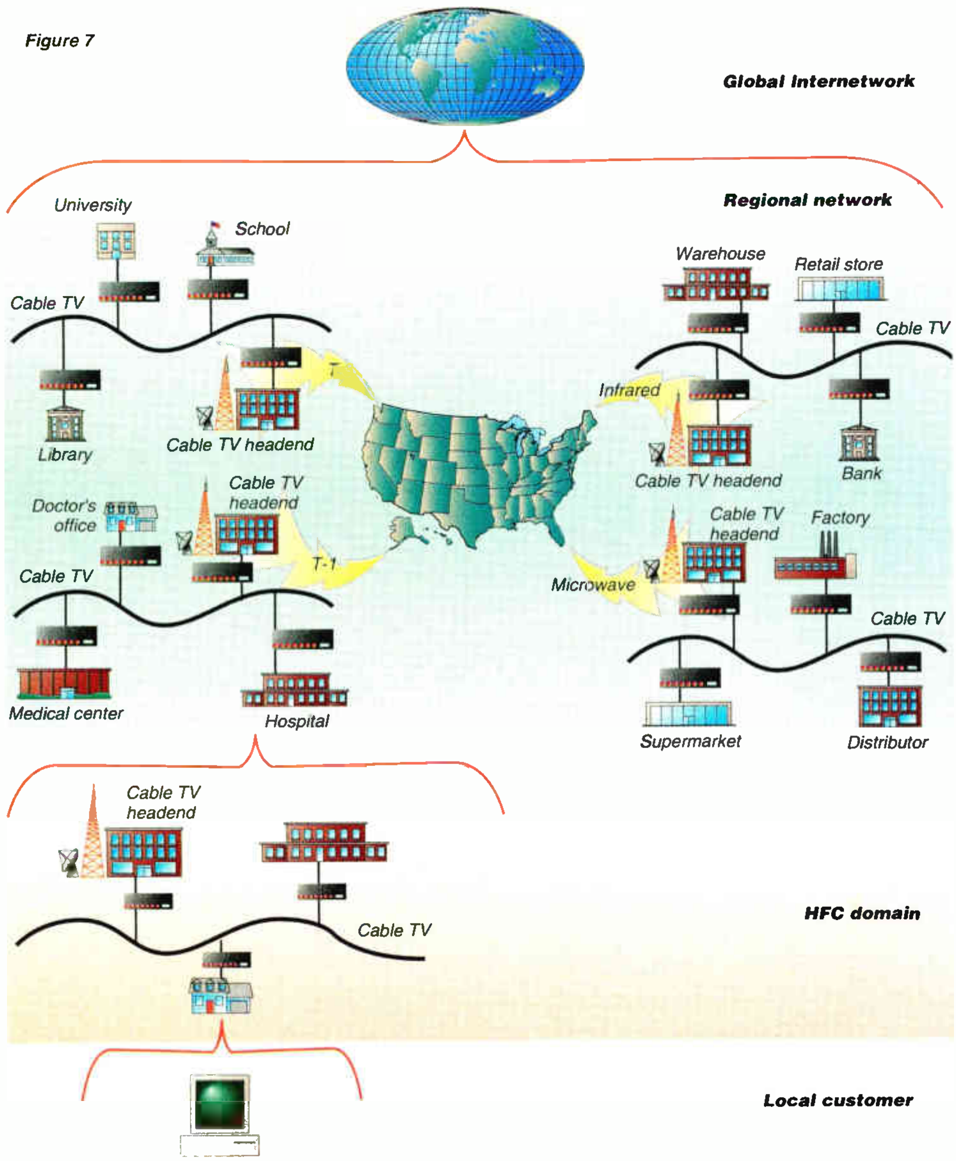
Switched internets are based on a different paradigm altogether. They provide point-to-point connections between hosts, similar to the telephone network. This enables a switched network to provide a guaranteed quality of service and dedicated bandwidth to a node. The switches themselves are complex devices, however, and problems with support for broadcast and multicast traffic lead to difficulties in supporting existing LAN-based applications which are often dependent on these features.

A recurring debate in networking occurs over the relative benefits of bridges, routers and switches as the gateways to interconnect different networks. For an HFC-based internetwork, this debate is somewhat moot, as the applications to be used determine the best interconnect mechanism, and the HFC internetwork must support customer networks based on all three technologies.

Therefore, in providing an HFC communications infrastructure, the optimum solution is to be able to offer all three options. Fortunately, this is simple to achieve by adapting to industry standard networking principles invoked over the last 25 years.

In currently deployed networks (and in the immediate future), the interface between local LANs and the wide area networks used to link them are provided by router-based technology. This remains the technology of choice to link local LANs to an HFC-based internetwork. As ATM switches develop, they may replace routers in this function. The major changes in an evolution from routed to switched ATM gateways will be the added service classes which can be supported.

Figure 7



HFC-based internetwork

Two distinct models of computing can be considered with very different requirements: asymmetric and symmetric. If the network hosts are seen as consumers of data which is retrieved from outside the network and inserted at the headend, then they have an asymmetry in bandwidth needs which matches the network topology. In this model, hosts in the HFC internetwork are not providers of data in large volumes. This may be a plausible model, especially for consumer services such as access to the Internet and database services.

If LAN-based data networks are taken as the model for the HFC internet, this asymmetry in bandwidth requirement disappears as the model becomes one of peer-to-peer networking in a client/server environment. In this case, the hosts on the network are both sources and sinks of data. This model has displaced the traditional computing model of terminals accessing a central host in many business environments and must be supported by any HFC internetwork which wishes to attract business and work-at-home customers. This model also fits the needs of video telephony, which is inherently symmetric.

Thus, in selecting the technology for the HFC internet, the capability of supporting one or both of these models needs to be considered. In a symmetric model, the headend may be a simple frequency translator with sources and sinks of data distributed throughout the network. In an asymmetric model, however, the headend becomes significantly more complex as it must deal with data extraction from the upstream paths and insertion of off-net data into the downstream.

The HFC internetwork is built from the following major components:

✔ Local area networks and users interconnected to the HFC via cable TV modems

✔ An HFC domain connecting 500- to 2,000-home nodes together

✔ Master headend equipment linking the HFC domain to the regional headend

✔ Regional headend, high-speed digital backbones providing connectivity to a master headend

✔ A global network, existing worldwide information source doorway to the global internetwork. (Refer to Figure 7.)

A key feature of providing a successful internetwork based on these (or any other) components will be to maintain as much independence as possible between components. In this way, the underlying technologies of individual components can be upgraded without the need to rebuild the entire network.

The global internetwork will be based on

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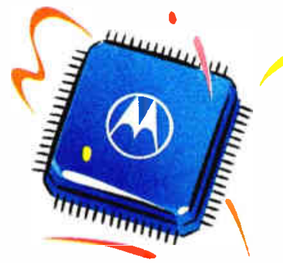

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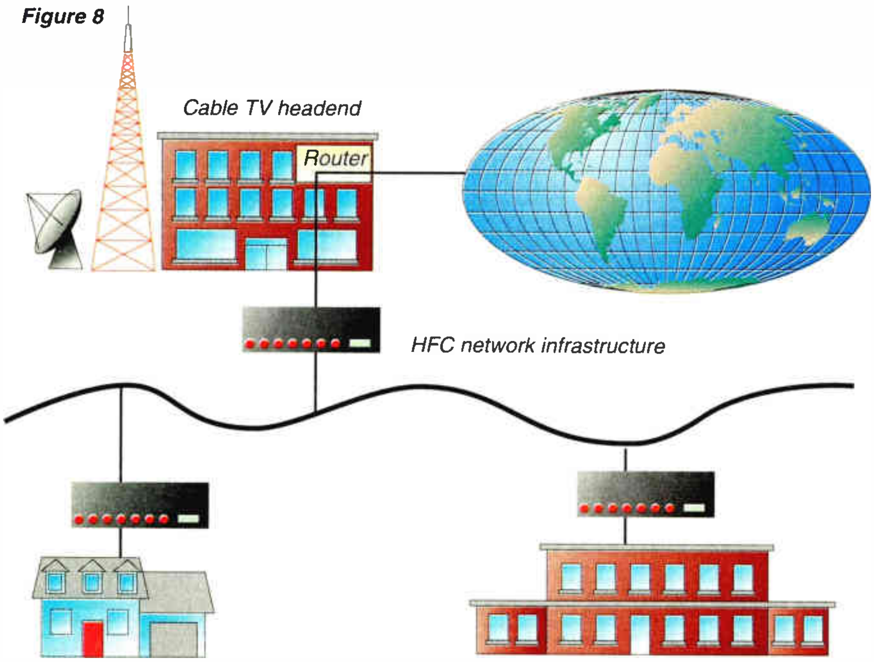
Figure 8



services provided by wide area carriers. The link into the WAN will be matched to the traffic load, T-3 (45.75 MHz and up). The interface will be via a high-speed switch or router, depending on the type of service required. This is the main interoperability point between the cable TV industry and existing telco industry.

The high-speed digital backbone, or regional headend, will be based on a fiber optic network such as ATM. The topology and exact technology used will vary on a case-by-case basis depending on the data rates required and the locations to be connected.

The connectivity between the HFC domain and the regional headend will be based on switches or routers with adapter cards for the specific physical interfaces required. The major functions of this connectivity are: conversion from HFC media to backbone media (e.g. coax to fiber); conversion from an HFC data link protocol to a backbone protocol; and routing or switching between HFC channels and to and from the backbone. The HFC domain provides the last mile of connectivity for the user to the coax cable plant supporting clusters of approximately 500 to 2,000 homes.

There has been much written to indicate that ATM-based networks are the wave of the future. Thus, how an HFC network can provide support for ATM-like services should be considered. ATM-based networks are poised to offer a class of services to support voice, video and other time critical applications which are an extension to current LAN technologies. Applications will be developed based on these services, and an HFC-based internet should be capable of supporting these application types over a metro area. This will require the provision of a shared media/multidrop access mechanism capable of supporting cell-based data transport; access to WAN (frame relay, wide area ATM); and emulation of ATM services (using the same API as native ATM networks).

The services to be provided over the network should follow the classes defined by CCITT for ATM. This should provide support for the required applications. Class A is defined as a continuous (constant) bit rate application such as pulse code modulation (PCM) telephony. Class B is defined as a variable bit rate non data application such as compressed voice. Class C is defined as a connection oriented data application. And Class D is defined as a connectionless data application.

Network management and operation

For the network to provide the required services to customers with the highest possible up time and the lowest possible cost, the network infrastructure must support an adequate set of operation and management features. The functions which must be provided include network management, configuration support and accounting support.

The cable TV network operator must be able to monitor and control the network components on a day-to-day basis. Three key features of the HFC environment impose constraints on the network management solution which are not found to the same extent in a LAN environment. These are the size of the network, the low cost of end units, and the broadcast media. Because of the distributed nature of devices attached to the HFC network, it is critical that all network management operations are supported remotely. It is not practical to require any (re)configuration to be performed locally at a device once initial installation is complete. In fact, in an ideal situation, devices should be self configuring even for the initial installation. This is practical for simple devices such as cable modems. Support for an out-of-band mechanism as a back-up link to reach key infrastructure components when the inband network is non-operational is required.

The HFC network is a shared medium. In order to ensure that network management operations from malicious sites do not compromise network integrity, authorization of all management commands may be required as a security option. Encryption of network management commands may impose a greater overhead than the end devices can tolerate.

Frequency allocation is one of the key tasks for HFC network operation, and reallocation of frequencies must be performed under strict security. It is essential to the HFC network that only an authorized source is allowed to modify the frequencies of any devices in the network. It is less essential to provide security in terms of not allowing read access to certain devices. Therefore, a network management system must be able to allocate frequencies using a mechanism which guarantees authorization (but not necessarily encryption). Additionally, a device must not transmit without a valid (authorized) frequency allocation.

If the network devices obtain their configuration from a central server using a protocol such as DHCP, there must be a mechanism for a device with minimal software and configuration data to know the transmit and receive frequencies to use for attaching to the server to obtain configuration data (the chicken-and-the-egg problem). Devices powered off or disconnected from the HFC network when frequency changes are made cannot be allowed to power up, attach to the network and begin transmissions using potentially old frequencies.

The management and operation functions described must be mapped to the components of the network. For network operation purposes, these fall into three basic categories with each category providing a piece of the solution: end nodes, network infrastructure and network management specific components.

End node devices are typically under user control. They are customers of the network and obtain services from it. These devices are generally cost sensitive, and network management must not impose high overheads on them. They may provide information for management but cannot be relied upon and must be restricted in what they are allowed to do.

They should support a network management protocol such as SNMP where possible.

Intelligent network devices such as bridges, routers and switches are part of the network infrastructure. These devices must support a network management protocol such as SNMP. Their primary function is to provide the basic data communications services, and as such, they are under the network operator's control. For the network to function efficiently they must provide significant network management information and be able to implement management policy (e.g. access control, traffic filtering).

Network management specific devices provide management and operations support. These devices are typically specialized hardware and/or software platforms under the network operator's control which are optimized for their support functions and allow operators to implement network management policies. (See Figure 8.)

An HFC-based management platform should be able to provide both performance and fault management statistics to a cable TV operator either remotely or locally. This capability enables the network manager to become proactive in not only the management of the data network, but the HFC system as well. Each cable TV modem could keep a running history of events that it has seen occur with date and time stamps. By reviewing the recorded entries within the cable TV modems and correlating their occurrences to physical locations on the HFC system, both performance and fault isolation management can be done.

Devices in the HFC network infrastructure must provide the operator with sufficient information to be able to monitor network performance in order to resolve problems and to plan for growth. They must be flexible enough so that the operator can manipulate bandwidth assignments to use network resources to their maximum. Performance related statistics for individual network devices that must be maintained at each site may include: signal level, BER level, enable/disable status, and filter and forward rate. They should also maintain such statistics as: average and maximum loading, uptime and site specific parameters.

The fault management feature of the network infrastructure should allow the devices to provide the cable operator with sufficient information to resolve problems. Devices must maintain statistics showing both the current operational state and any limits exceeded in the past. Examples of valid statistics would include: error counts and rates for physical layers on both local and HFC media, protocol errors and RF signal quality parameters.

The network management scheme selected for an HFC-based internetwork must satisfy the requirements called out above. However, a network must be capable of providing connectivity to a larger based internet. For ease of integration and support, it should be manageable using the same mechanisms as the components which comprise these networks today. The management protocol must be based on an existing standard, such as SNMP or SNMPV2.

The cable TV operator must be able to configure parameters for both the HFC network infrastructure and the host/user devices (i.e. cable TV modems) attached to the network. This requires appropriate hooks built into each device, including:

1. What is the delivery of service available from the network? Different hosts may subscribe to different classes of service with different cost structures.

2. What address to use. In a large internetwork, automated support for assigning (and reassigning) host addresses will be essential.

3. Which part of the frequency spectrum to use. The network operator may wish to allocate frequencies to different services at different times. A host should have a mechanism to determine its current allocation.

For a network to be able to support a significant number of hosts, the configuration data must also be centralized and relatively easy to use. This leads to the concept of a configuration server for the network providing a database (probably maintained via an RDBMS application) which is accessed from the hosts. This access would be based on an industry standard protocol such as DHCP.

The distinction between directly connected and indirectly connected devices is significant to the complexity of the configuration issue. For example, a PC connected to the HFC network would need parameters (and thus a unique ID), while a PC residing on a LAN and connected via a LAN-to-cable-modem gateway would not need parameters (although the cable modem gateway would). Thus, as the network migrates from a model of networked LANs to a model with directly connected hosts, the configuration issues become much more problematic and require an appropriate addressing scheme.

A simple mechanism to achieve a unique identifier for devices with connections to the cable is to require that all such devices have a unique MAC address. Two basic approaches can be taken to guarantee address uniqueness. Addresses could be assigned regionally through administrative authorities with policies in place to ensure addresses are local, or they could be assigned to manufacturers, ensuring global uniqueness. This will simplify the management and implementation with a central authority providing blocks of addresses to manufacturers. Using a LAN-based system such as Ethernet's 48-bit address provides sufficient scaling and has worked for current LANs. Maintaining the Ethernet-like structure allows the use of existing server-based schemes.

The cable TV operator also needs to be able to provide billing for services used. This can be achieved in several different ways. If the philosophy is to charge for usage, a device must exist on the HFC network infrastructure to detect all traffic, calculate the billing costs and record the data. This device must be 100 percent available. Alternatively, the user may have purchased a certain quality of service from the network provider. The host will be required to register with a central utility on the net to receive the services it is assigned. The host will determine the functionality it can provide based on the tokens it receives back from the service broker.

Conclusion

A cable TV HFC network can provide up to a 1,000-times higher data rate, at a far lower cost per bit, than any public telephone network. For example, a cable TV modem at 10,000,000 bits per second (10 Mbps) is 350 times faster than a comparably-priced external phone modem at 28,800 bits per second (28.8 Kbps). The adoption of industry standard networking by cable TV equipment providers has allowed hundreds of commercial cable operators all over the world to deploy scalable, high-speed networks and provide a variety of new services to their customer base. It is estimated that the size of the market for providing data over cable TV will grow from 100 million in 1995 to 16 billion by 1999 . CED

This article was produced as a collaborative effort by the following LANcity staff:

Les Borden (internal editor); Chris Grobicki (MAC); Kevin Mousseau (QPSK); Mike Sperry (physical layer); Gerry White (internetworking & network management); Rouzbeh Yassini (HFC network architecture).

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Billing vendors retool for ops' new demands

Organizational, product changes

By Dana Cervenka

Subscriber billing is no longer a mysterious function lurking in the cobwebs of the back office–it is being yanked out into the light by MSOs who see it as the key not only to implementing the full service network, but also to capturing sources of revenue that were previously unthinkable for cable operators. And as MSOs increase their billing system requirements exponentially with the advent of transactional services, traditional cable billing vendors are responding by re-engineering their companies to offer the next generation of products.

As TCI's Senior VP of its Advanced Information Technology Group, Sadie Decker, puts it: "We needed a whole new concept of delivering the bill." TCI recently announced its new Summit subscriber management system, designed to handle billing, advanced marketing functions, customer service, internal communications and workforce management. Developed to run on a Sybase software engine, the system is dramatically different from anything that the telcos have, says Decker, who adds that TCI is developing the applications that run atop the platform inhouse because the MSO "didn't think there was a vendor out there who could do it as well as we could internally."

A global economy

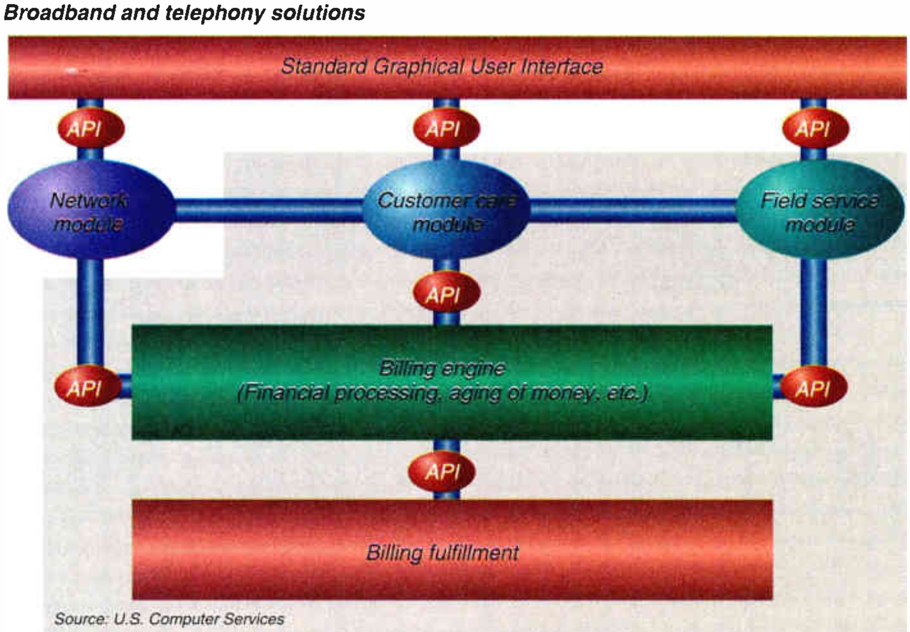
Companies like California-based U.S. Computer Services, parent of CableData, have become acutely aware of the changes in the billing market, and are essentially restructuring themselves to be more responsive to the demands of the transactional environment. On March 31, the company created two subsidiaries out of its former operating components: one of those subsidiaries is CableData Inc. US Computer Services is now a holding company that provides staff support to the two operating companies.

Creating the new structure also resulted in shifts at the company's executive level: at press time, Michael McGrail, president of CableData's International Division, added the position of president and general manager of CableData Inc. to his duties, succeeding former President Jerry Knapp, who left the company. Concurrent with that announcement came the news that Bob Crowley, USCS senior vice president of Marketing, had also left the company. Assuming the marketing duties is C. Randles Lintecum, who has been appointed senior vice president of marketing and business development. Dr. James Castle remains at the helm as chairman and CEO of USCS. A new convergence group manager will also be named in the near future.

The new structure was also created in response to what those at the top perceived to be an acceleration in the convergence of the telecom industries. For example, in places like the U.K., where cable operators are already offering telephony services, CableData has had its Intelecable transactional billing product up and running for two years. Intelecable is also running on systems in five other countries, and CableData has commitments from nine others. Company officials want to apply the international experience gained with the product to the U.S. market. To that end, McGrail has been brought over from London to give an international flavor to CableData's development; it's also noteworthy that he has been involved in merging the operations of other international corporations before.

Instead of trying to be all things to the cable market, CableData is now concentrating its resources on providing a single billing, or transaction management engine capable of addressing all the convergence target markets. The company's second focus is statement mailing and production. In keeping with the organization's new approach, its billing and statement modules are designed with open interfaces to fit in with other vendors' products. "What we found in talking to various companies, more in the United States than overseas," says Castle, "is that they would like to design the front-end, have their own GUI interface, and maybe even work a bit on the backend."

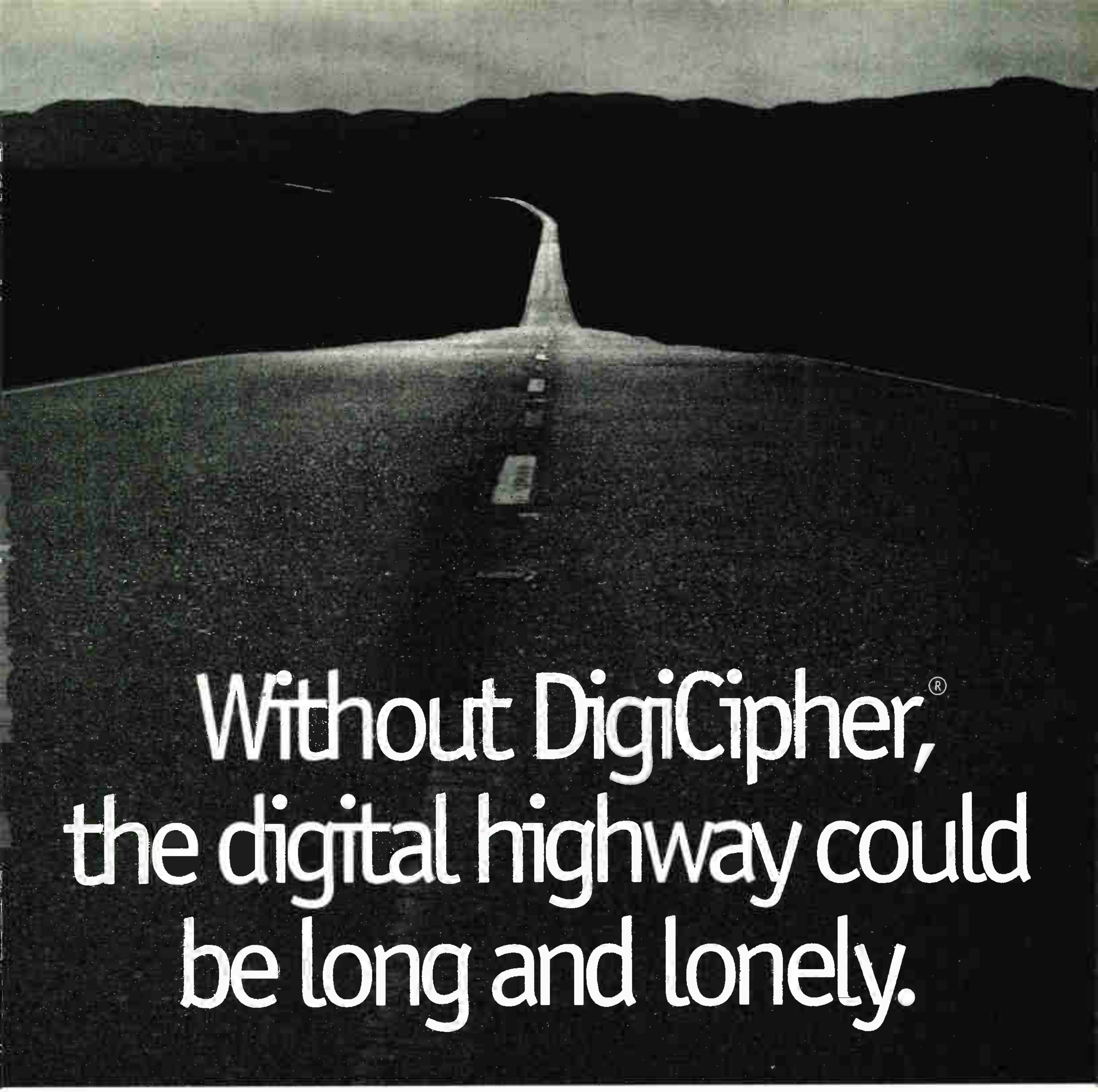
Broadband and telephony solutions



Source: U.S. Computer Services

Essentially, the realignment merged the domestic and international divisions of CableData, explains Castle, to better handle the global nature of the cable and convergence markets. "We would call on customers internationally and find that they were the same customers that we were calling on domestically, and in the convergence [business]," notes Castle. "We had three different sales forces potentially calling on the same customers."

CableData's international headstart with its transactional product has not gone unnoticed: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the digital highway could
be long and lonely.

the company recently announced a contract with BellSouth to provide the Intelecable business support system (BSS) for the telco's video dialtone trial in Georgia. And the billing provider's changes seem to be well-received by the telecom industry as a whole: in addition to the BellSouth contract, the company will soon announce an agreement with a local exchange carrier for "more than a trial," according to a company spokesperson. In addition, execs are close to putting together deals with at least three other entities, and are talking to MSOs, RBOCs and long distance carriers, to name a few.

A shift in mindset is also apparent in the company's dealings with other vendors who might, in another climate, be competitors. The company has signed cooperative selling alliances with Tandem, Bellcore, AT&T and Oracle, has a long-standing relationship with IBM, and is in the midst of discussions with other companies, including Microsoft and Sybase. While in most cases, CableData assumes the role of systems supplier, says McGrail, that is not the case in every country. "Overseas, we tend to let our affiliate partners be the system integrator, or the prime contractor," he explains. "We provide the product to them, and they resell it."

And even though the billing vendor's relationship with some of its customers, like TCI, is changing, Castle does not think that these developments will have dire consequences. "They will continue to be our customers for some time to come–we have a long-term contract with them," says Castle. "It will take awhile for convergence to take place–not weeks, but months or years." Further, Castle predicts that his company will continue to provide statement production capabilities to TCI, even after the MSO's new Summit system is up and running.

Out of the chute

The case of Plano, Texas-based billing powerhouse EDS is a bit different. While the company has been in existence for 30 years, it has only been offering billing support to the cable industry since 1991. As a new market entrant, EDS's task was to come out of the chute with products designed to handle the new, transactional services. The company also entered the cable market with a different focus: to be a full service provider. "We have experience, capabilities and core competencies in customer service, telemanagement, network management, remittance processing, systems integration and systems development, as well as billing," notes Mike Hosmer, president, EDS Cable Television Services. "Billing is just one of the services that we can bring to the table."

That strategy means the company will be competing with the likes of not only CableData and Cable Services Group for the billing business, but also with Oracle, Sybase and AT&T for full service systems.

The company's first contract for one of its transactional subscriber management information systems, called INFOplus, was with Viacom Cable for its interactive trial in Castro Valley, Calif. Implemented in the spring of 1993 in a beta test mode, the software was chosen to handle both subscription-based processing as well as future transactional processing requirements. In the spring of '94, EDS signed a nine-year strategic agreement with Missouri-based Galaxy Cablevision to supply services that include the INFOplus package, and to produce, print and mail bills to the MSO's 60,000 subscribers.

On the telco side, INFOplus is being used by Bell Atlantic for its technical and marketing trials in Alexandria, Va.

Because all of its customers and prospects have vastly different service requirements, EDS has elected not to pre-package its billing and information management products, but instead, to focus on building applicaton-specific interfaces. As an example, one of the interfaces it recently implemented is for Qualcomm's OmniTRACS, a satellite-based fleet tracking system.

The task facing companies like EDS in the transactional arena is clearly defined. "Because of the confusion in the marketplace regarding federal legislation as well as convergence, it's very challenging to keep up with the direction that all the cable companies want to go in," says Dick Maul, vice president–Sales, EDS Cable Television Services. "They are all literally wanting to go in different directions."

An acquisition

Changes at Cable Services Group became evident as far back as November of 1994, when the company was acquired from First Data Corp. by CSG Holdings Inc., a partnership of Morgan Stanley Group Inc. and Trident Capital, L.P. Now known as CSG Systems Inc., the billing products provider counts among its customers 13 of the top 25 MSOs, including TCI, Comcast and Time Warner.

CSG Systems is apparently still in transition, as top executives at the company were unable to be reached for direct comment, choosing instead to respond via a prepared statement. According to that information, provided by President and Chief Technical Officer Dr. George Haddix, CSG intends to expand its reach beyond service bureau processing, and "offer a number of new products based on open architecture, distributed systems." To that end, its product portfolio will soon include customer care programs, database management, marketing services and billing statement processing and mailing for both cable systems and telcos.

Some of those new products are scheduled to debut this month, at the NCTA show in Dallas. CSG, in concert with its consultants, has built a client/server based platform for its new products, which are engineered to operate on UNIX hardware, and which incorporate a graphical user interface (GUI). Known as the Advanced Customer Service Representative System (ACSR), the GUI is already being rolled out by CSG; in addition, the company is selling an enhanced statement program, ESP. CSG plans to license its basic software packages to cable systems and telcos, which means that the operators themselves would modify the packages for their specific applications.

Market shifts

Clearly, what MSOs like TCI are after is complete control of their systems. Time Warner Communications, the telephony arm of Time Warner, wants the same thing. What neither company wants is to be locked into a vendor's proprietary software, resulting in multiple systems that cannot talk to each other to share information. "For the software we buy off the shelf, we tell vendors, you play with us only if you talk to our data model," emphasizes Steve Pearse, Time Warner Communications' senior vice president of engineering and operations (see "Spotlight," page 20). Pearse is utilizing a Sybase software engine to direct the development of Time Warner's own proprietary applications for billing, OSS and ISS.

By designing their systems with open interfaces, billing vendors do seem to be gearing up to meet these demands for interoperability. But TCI's Decker sees additional, new opportunities for traditional billing vendors. For one, the terrific expense involved in designing billing and subscriber information management systems from scratch will be prohibitive for smaller operators, notes Decker, who anticipates that the numerous, small telephone companies which will be born out of convergence will gravitate toward the traditional billing houses.

For another, it's unlikely that MSOs which do not have the resources of TCI or Time Warner will be able to undertake adventures in software engineering.

At any rate, no one can accuse billing vendors of waiting passively for the telecommunications market to redefine itself. CED

Cable, telecom convergence on display

Sonet, ATM come up big

By CED staff

While last year's SuperComm show in New Orleans was considered a watershed event because of the influx of both cable TV engineers and several traditional cable TV equipment suppliers, this year's event, while well-attended, seemed to lack the blockbuster new product and alliance announcements that dominated in 1994. Indeed, while some long-promised new products began to appear in booths, the number of products that were absent was even more notable.

For example, working demonstrations of cablephone systems were evident in a few booths, but no one outside of Tellabs and perhaps ADC Telecommunications is expected to debut a product before 1996 dawns. Also still missing: Robust RF modems for high-speed data transport over the HFC network. GI officials hinted that such a product would be on the show floor at the NCTA convention, but also said it would be at least a year before a good RF modem is available for under $500.

On the other hand, several new products that made their debut, especially in the ATM (Asynchronous Transfer Mode) and Sonet categories, are worth noting here.

For example, Hitachi announced that its new OC-192 Sonet terminal will be available to the marketplace in the fourth quarter of 1995, making it among the first to offer such a high-speed interconnection solution. The AMT-5192 terminal can be used for point-to-point applications, interconnecting optical hubs, add/drop chains and self-healing two- and four-fiber bidirectional rings.

Such high-speed optical devices are important to cable operators as they begin to tie together regional hubs and master headends to serve entire regions. Even OC-96 devices typically didn't offer enough capacity for video providers, often forcing cable MSOs to adopt non-Sonet pulse code modulation solutions.

Fujitsu, meanwhile, touted its new FLASH-192 Sonet system, which operates at 10 Gigabits per second. It's upgradeable from an existing OC-48 system and offers unidirectional path switched ring protection, in addition to two- and four-fiber bidirectional line switched ring protection.

In addition, Fujitsu introduced a new OC-12 interface to its access and transport system. The enhancement allows service providers to use a variety of rates, including DS-0, DS-1, DS-3 and OC-3c in the local loop. Finally, the company developed a full-featured, OC-48 bidirectional line switched ring to go along with its unidirectional path switched ring.

And Tellabs announced new OC-3 and OC-12 optical interfaces for its Titan 5500 digital crossconnects to help reduce costs by eliminating the need for separate terminals.

Alcatel transported HDTV signals over ATM and Sonet around its booth, proving that both technologies are real. Alcatel is working with Pacific Bell to deliver movies to theaters in California as part of the Cinema of the Future project.

Most of the engineers who attended from cable systems were scouting out Sonet and ATM solutions, and getting a glimpse of upcoming cablephone systems. Although cablephone products don't yet exist, there's no shortage of companies developing such a product, including Tellabs, ADC Telecommunications, Philips Broadband Networks, General Instrument, Scientific-Atlanta, Unisys, and newcomer NEC.

NEC is developing two enhancements to its digital loop carrier product to provide telephony over hybrid fiber/coax networks. The first iteration is an RF modem that modulates digital telephony signals into RF carriers, that is coupled with a curbside unit that houses 12 line cards to serve up to eight subscribers.

Alternatively, NEC will offer a high-speed RF interface card that replaces the optical card in the DLC. It modulates four T-1s on a single carrier, which are then demodulated by another unit in another digital loop carrier.

Time Warner details fiber deployment

Time Warner Cable revealed its plans to push fiber even farther into its networks, dubbing the new architecture "fiber-deep," or fiber to the bridger. As previously announced, the MSO is racing to upgrade much of its plant to 750 MHz, driving fiber down to 500-home nodes, an architecture the company refers to as "fiber-rich."

In locations where it makes good business sense, however, Time Warner will be deploying fiber even farther down the line to nodes of 125 homes, according to Donald Gall, a senior project engineer for Time Warner Cable, who spoke during a SuperComm luncheon sponsored by laser manufacturer Ortel Corp.

The depth of fiber deployment will depend on both the density of the plant and the prevailing local business conditions, says Gall, adding that the fiber-deep approach seems best suited to areas having a density of 75 homes per mile.

In one example, the company is conducting a trial in Monroeville, Pa., with 200 of that system's 330 plant miles slated to be converted to the fiber-deep architecture.

The deeper fiber penetration better utilizes the full capacity of the DFB laser, which puts out enough power to serve more than one node, according to Larry Stark, vice president, new business development, at Ortel. The architecture also requires fewer amplifiers, and thus, less electrical power.

Both architectures will be more than adequate to meet or exceed the Bellcore standard for telephony services of no more than 53 minutes per year downtime (99.99 percent availability).

ATM moving into mainstream

ATM was on the menu at a session discussing the transport of the technology over Sonet (Synchronous Optical Networks). There are three main drivers for providing broadband connectivity at present, according to Jose Verger, ATM product manager with Pacific Bell. Those factors are the dispersion of computing power, the increase in bandwidth intensive applications, and the demand for inter-enterprise connectivity.

Service internetworking is the key to securing long-term investments in the technology on the part of business customers, says Verger, who adds that Sonet and ATM will be the two primary ingredients of any future broadband network.

The Sonet/ATM marriage is especially well-suited to provide a basis for the full service network, according to Mark Barratt, director of strategic planning for Fujitsu Network Systems, but the key to the FSN is the mapping of ATM and Sonet transport. While Sonet brings reliability and standard,

open interfaces to the FSN, ATM increases network capacity through concentration, and allows the transport of mixed media (i.e, video, voice and data) via packetization.

Speaking from the IXC perspective, Chuck Norman, manager of standards at Sprint, notes that the two technologies provide carriers with a unique opportunity to essentially rebuild their networks from scratch. This powerful technological combination will also provide the opportunity to realize the dream of seamless, global interconnectivity.

Challenges that still need to be addressed, however, include the need to make the technology "plug-and-play," and restoration issues: while self-healing Sonet rings are available today, restoration on ATM switching is still being studied, according to Norman.

The integration of Sonet and ATM also presents testing challenges that need to be answered, says V. Prasannan, marketing manager at Tektronix Inc. Future demands on test equipment will include the need for repeatable, comprehensive, automated, error-free testing; the necessity of reducing testing time, which translates into easy problem identification and a graphical user interface; and a flexible architecture that allows for system upgrades.

C-COR shows amps, net management

C-COR Electronics Inc. displayed its new family of broadband amplifiers, designed for AT&T, at SuperComm. The manufacturer also utilized Anaheim as its venue to demonstrate its new Cable Network Management (CNM) system.

The series of six bi-directional amplifiers, featuring a forward path of 54-750 MHz, and a return path of 5-40 MHz, were designed to meet the requirements of coaxial-based telecommunications systems, which are a part of AT&T's HFC and SDV (switched digital video) platforms.

The series includes three Express amplifiers, two bridger amplifiers and one tap amplifier. C-COR plans to produce the line in its new Reedsville, Pa. facility.

Also in the C-COR booth was a demo of the company's CNM system, which monitors the manufacturer's digital fiber, AM fiber and RF electronics as they are used in HFC networks. Features of the system include fault prediction capability and automatic inventory/provisioning management, as well as a graphical interface which facilitates the location of system failures.

The CNM system tracks network elements, as well as installation and repair data, for inventory/provisioning management.

Nortel intros new switch, contracts

Northern Telecom, now known as Nortel, made a series of announcements regarding ATM switching, as well as recently-signed supply agreements, during a press briefing at SuperComm. Keying on the industry's interest in ATM, Nortel introduced the Magellan edge switch as an element for building comprehensive, carrier-based networks. The switch offers scalable throughput from 2.5 to 10 Gigabits per second (Gbps), as well as support for both switched and permanent virtual circuits, central office packaging and multiple ATM interfaces.

BNR and Nortel are developing the Magellan switch using technology obtained through the alliance with FORE systems. Global customer trials will begin sometime before the middle of this year, with general availability slated for the second half of '95. Southwestern Bell Telephone is already using the Magellan switches in a trial being conducted by JC Penney, which is testing high-speed, multimedia services that interconnect is corporate headquarters with company data centers in Texas and Kansas.

Nortel also announced that it has signed a letter of intent with Pacific Bell to be the primary supplier for the video transport backbone serving the telco's HFC network. That network will start delivering voice, data and video services later this year to customers in certain parts of California.

Nortel's Cornerstone Super Trunk application, based on Sonet, will be used in the backbone. The super trunk technology provides integrated transport of analog, digital and interactive video, as well as digital music, the Sega Channel and FM radio signals.

And Omnes, a joint venture of Schlumberger and Cable & Wireless, has purchased two Magellan Passport enterprise network switches plus associated DPN-100 equipment and Magellan access switches. The venture will evaluate Nortel's Magellan switching systems to upgrade the capabilities of its global voice and data network.

During the briefing, Nortel also brought in users of its technology to discuss broadband video networking applications including distance learning and infrastructure upgrades.

IBM unveils new business centers

In the course of private press briefings at the show, IBM announced two new centers which will provide network management application development and integration services and solutions development for the worldwide market.

The IBM Telecommunications and Media Solutions Center, based in Austin, Texas, will open this summer as a development facility providing network management, information services and Advanced Intelligent Networks (AIN), as well as content creation, storage and distribution. All of the applications will run on IBM's RISC System/6000.

The Telecommunications and Media Development Center, in Piscataway, N.J., began operations last year and offers applications designed to ensure the reliability, efficient operation and performance of the new broadband services networks that many telcos are installing.

E/O brings fiber to rural America

Life on the farm–it'll never be the same. Not after E/O Networks concludes the first field trial of its new Fiber Distribution System (FDS-1), also known as "fiber-to-the-farm," and brings fiber optic-based telecommunications to the low-density, rural marketplace.

E/O Networks initiated its first trial, with Brookings Telephone of South Dakota and rural network consulting firm Martin & Associates, to bring basic telephone service to 40 of the telco's subscribers.

E/O used SuperComm as a forum to demonstrate how interactive video and data services, as well as telephony, can be delivered over the existing copper plant by utilizing its product. The company's development partners, Tut systems Inc. and Stellar One, contributed, respectively, a special line card to interface to the copper plant, and the Stellar 1000 set-top with an interactive navigational system, to the demo. The demonstration transported MPEG-1 video from a server, along with the telephony bitstream, to an Optical Network Unit (ONU).

Why would a rural telephone company be compelled to upgrade to fiber? First, because life on the farm truly isn't what it used to be–more and more, rural customers are requesting advanced applications such as telecommuting and distance learning, says Leif Hoglund, vice president of marketing for E/O. Another factor driving the upgrade is the degradation of the existing copper plant in rural America, much of which was installed just after World War II.

According to E/O officials, the FDS-1 supports 384 telephone subscribers on a single fiber ring; 750 MHz broadcast video; high-speed data services; a fiber distribution loop covering 150 miles; and 30 ONUs. Cost of the system is in the range of $200-$1,000 per line, depending on subscriber density. The system's reliability is enhanced by the deployment of a counter-rotating ring architecture which provides redundancy in case of cable cuts. CED

Digital set-top approaches become clearer

Interoperability a key component

By Fred Dawson, Contributing Editor

The push to anchor digital media in the video pipeline has been making headway lately, thanks to compromises on set-top interoperability and the interfaces supporting content development across multiple platforms.

"Set-top functionality is going to be an area of contention for a long time, but that doesn't preclude interoperability if you take the right software approach," notes Russell Werner, vice president for new media at Sybase.

The realization that this is so and its implications for spreading the digital media reach across the largest possible worldwide audience have significantly altered the terms of the debate between the low- and high-functionality set-top camps. Now, it seems, each side can have its cake and eat it to, so long as the server can stick its finger in for a taste.

Bob Luff, chief technology officer of Scientific-Atlanta's broadband divsion and a member of the DAVIC management committee, says this point was central to the discussion at the most recent meeting of DAVIC (Digital Audio Visual Council), which took place in London in March. "There was a lot of support for a handshake between the server and set-top that allows the server to take advantage of higher levels of memory to offer a given service with a richer graphics layer," he says.

"We're going to see a spectrum of different capabilities in the set-top for quite awhile," adds Dino Lachiusa, architect for the content engineering group at Digital Equipment Corp. "One of the keys to success in this environment is agreement on a way to communicate from the set-top to the server to let the server know what type of set-top is in the session."

DAVIC, with more than 300 companies represented at the latest meeting, made considerable headway on set-tops and other points in the end-to-end system, thanks in part to a willingness to agree to disagree on functionality for the time being, Luff says. "People had been coming at this with a good deal of fear that one approach would win out and force everyone else to redesign everything they've done," Luff adds. "But in London there was better understanding of the points of interest where solutions could be chosen that work to the common good."

This meant recognizing that a complete definition of an end-to-end system was out of the question for now, with several issues to be either taken off the table or shifted to other bodies which are dedicated to standards in a single area, such as the ATM Forum. "Where set-tops are concerned, that leaves us with a focus on the things that achieve interoperability without necessarily resolving the functionality issues," Luff says.

"You have to have something like this approach if the telephone companies are required to support many types of set-tops in the video dialtone operating environment, as is likely to be the case," Lachiusa says.

Betting on compatibility

Indeed, one sign that the way has been cleared for interoperability across several levels of functionality is the RFQ issued recently by the platform arm of NPB Partners, the joint venture between Nynex, Pacific Bell and Bell Atlantic. The group, with Bell Atlantic taking the lead in the process, is calling for prices on several sets of specs encompassing orders for 200,000 analog boxes, 360,000 low-functionality digital boxes, more than a million "full functionality" (ATM) boxes and another 200,000 boxes in the full functionality class which will also have a second decoder supporting picture-in-picture displays.

"We're pretty sure at this point that we won't see the world going wildly off in another direction," says Mike McKeehan, system architect for the platform arm of NPB Partners, adding that progress at DAVIC is a big reason for his confidence. "As systems integrators, anything that will facilitate the delivery of systems to us is a good thing," he says.

Equally important is the role market agreement on interfaces is likely to have in extending the audience for digital media across multiple platforms, including discs, satellite and other non-wireline venues, which is essential to driving content development. "We'll have hit a home run when consumer electronics companies feel they can build products to specifications that match ours," MeKeehan says.

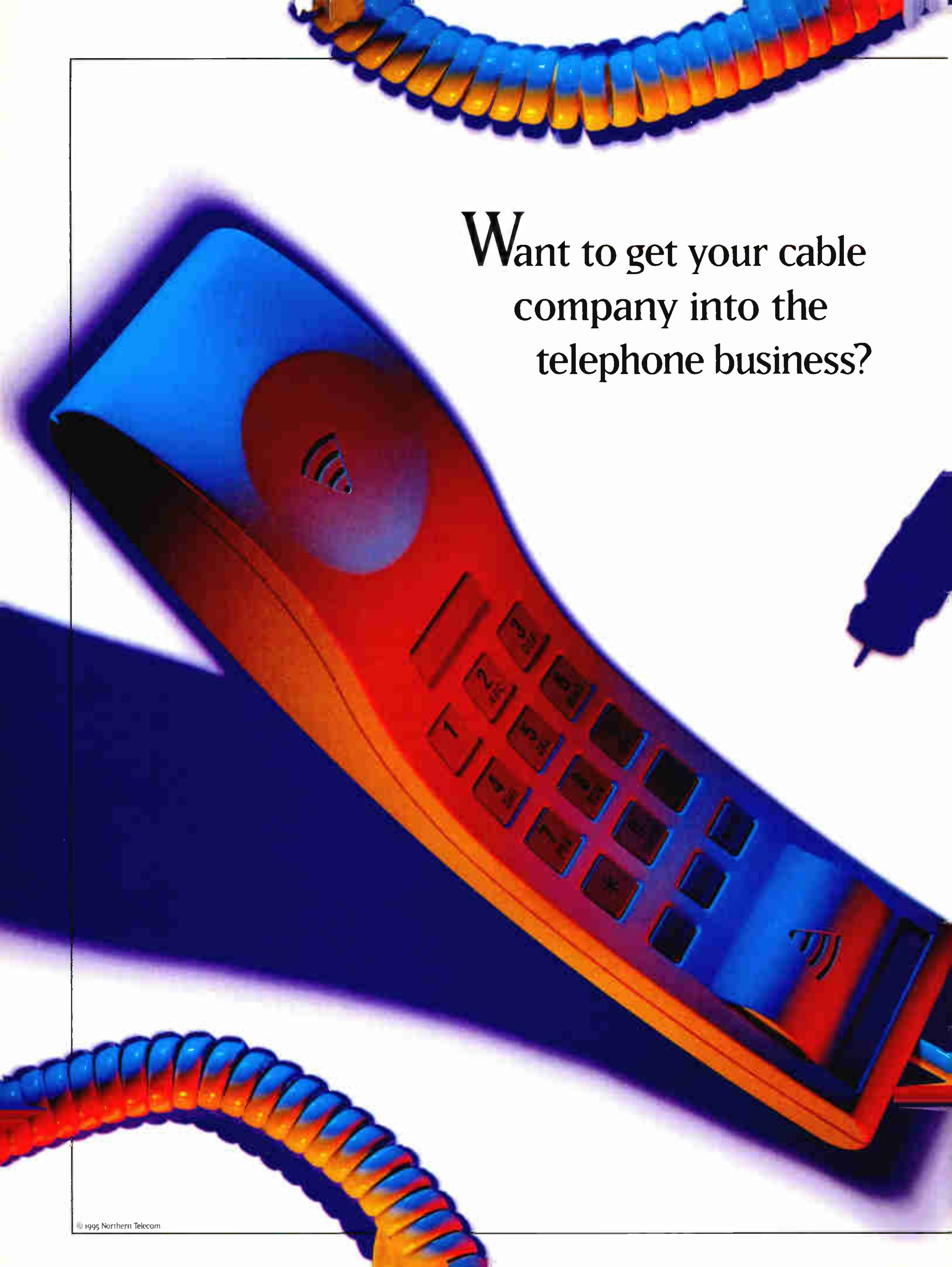
"We're seeding the market with these boxes," he adds. "Eventually people are going to go to Circuit City and buy product from JVC, Thomson or whoever integrates these capabilities into the TV set."

But while standardization around interfaces supporting the multi-hardware approach is a big boon to content developers who don't want to risk capital on limited-access venues, it falls short of resolving the hardware cost issue for network operators, Luff notes. If set-tops are to be affordable across the widest possible network base, the two camps need to agree on the RAM and other parameters of the basic microprocessor.

"The picture should be much clearer in three or four months," Luff says.

Supporting content development

Whether or not it is, the real issue confronting providers of digital services isn't silicon or software, notes Sybase's Werner. "We have to have content applications that are high enough in perceived value to generate consumer interest," he says. "We won't know what that means until we put a lot of things in front of the public, which is what the industry will be doing in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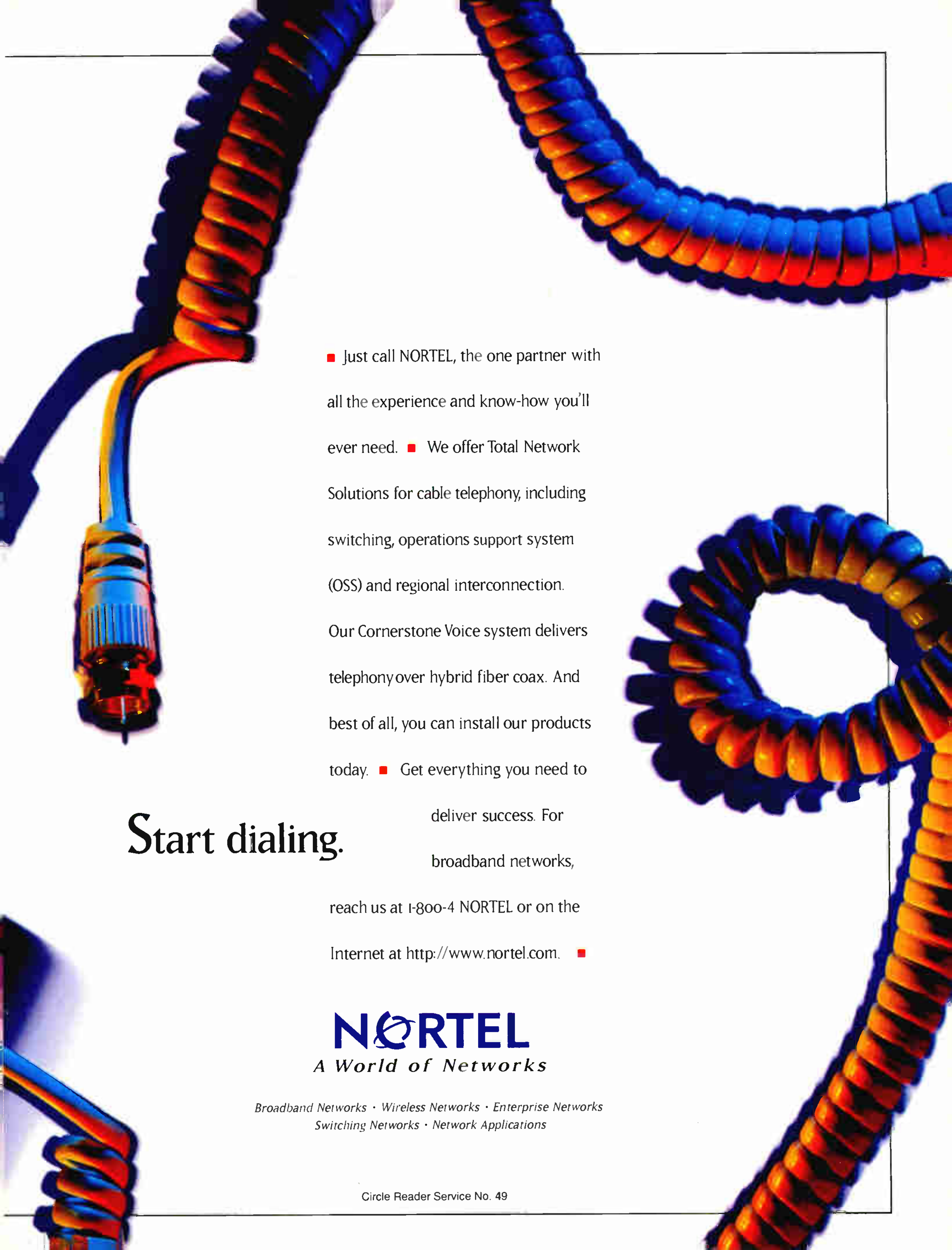
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One of the key parameter sets within the emerging DAVIC suite of interface protocols concerns the interface between the set-top and the HFC network, which is one of many delivery platforms for which similar interfaces to subscriber terminals are to be defined. There are four categories of interfaces, reflecting the variety of strategies for deployment of digital services.

Within each category of interface are several layers, with varying degrees of agreement on the specific protocols to be used within those layers. Each line in the figure below represents a layer; more than one protocol on the line indicates options in the approach to meeting the task at that layer. Encryption is not part of this interface.

S1 Downstream

MPEG 2-TS		
DVB	GI framing	SA-MRT
QAM		
Coax		

S2-Downstream

		IP
Private data		
MPEG 2-TS		
DVB	GI framing	SA-MRT
QAM		
Coax		

S2-Upstream

	IP
AAL5	
ATM	
GI MAC	SA MAC TDMA
QPSK	OQPSK
Coax	

S3-Downstream

DSM-CC	
IP	
Private data	AAL5
MPEG 2-TS	ATM
GI framing	SA ESF/PLCP
QAM	
Coax	

S3-Upstream

DSM-CC	
IP	
AAL5	
ATM	
GI MAC	SA MAC S-ALOHA
QPSK	OQPSK
Coax	

S4-Downstream S4-Upstream

Connection control is handled by service related control rather than by the STU. The S4 flow is not applicable at A1 interface

The categories of HFC/set-top interfaces are:

✔ S1: The network supports strictly downstream delivery of digital signals (typically above 450 MHz, with channel frequency assignments at 6, 7 or 8 MHz, depending on different world standards). Here the transport layer (top line) is MPEG-2, with framing options on the next line (see below for meanings of abbreviations). The next layer down is the modulation scheme, and, finally, comes the transport medium.

✔ S2 supports interactivity in an environment where the services are specified for a single type of set-top and interactive functions are carried out in a uniform manner within any given service category. Here the top layer contains the protocol for setting up the session, where the choice to the left of IP (Internet Protocol) is left blank, reflecting desire for another option but no agreement on what it should be. The private data layer is where instructions to the set-top on the presentation of services resides. In the upstream within S2, the choices are among industry protocols developed by General Instrument Corp. or Scientific-Atlanta on the one hand and, on the other, ATM (asynchronous transfer mode) cell relay using the AAL5 (application adaptation layer 5) approach to messaging in the cell header, which is less information intensive and therefore consumes less bandwidth than the AAL1 ATM trafficking format commonly used in telecommunications applications.

✔ S3 is a separate, out-of-band control channel that augments the service channels by supporting a broader range of interactive functions, updating of security and other information in real time, and more efficient addressing of individually targeted services. The channel permits a multiple set-top environment, where a connection control layer at the top allows the server to choose services based on set-top type. In this channel, ATM is an option, and modulation is QPSK, as opposed to QAM in the service stream.

✔ S4 supports an all-ATM service format over the HFC facility, where the capabilities in the ATM hierarchy of protocols are harder to achieve than in dedicated star/star networks. This is because setting up a session between customer and server requires information about which frequencies are used to transport the servcie, type of multiplexing, which node the customer is on, and more.

Terms (in order of appearance on charts):

MPEG2-TS: Moving Picture Experts Group transport protocol (188 bytes per cell)

DVB: MPEG framing, with "B" frames, as adopted by the European Digital Video Broadcast Group for direct satellite service

GI/SA-MRT: General Instrument and Scientific-Atlanta approaches to MPEG with "B" frames.

GI MAC: GI's medium access control system

SA MAC TDMA — SA's version of MAC, using time division multiple access

OQPSK: Offset QPSK modulation

DSM-CC: Digital Storage Media Command and Control, the set of server control protocols under development.

SA ESF/PLCP: S-A's extended superframe (DS-1 framing and synch) and ATM physical layer convergence protocol (mapping DS-1 to ATM).

SA MAC S-ALOHA: Slotted ALOHA, a MAC system for shared media. –F.D.

'96. "The tools are there. No matter what platforms people are talking about, nobody is remotely pushing the limits of existing software capability."

The existence of this capability is driving ever more strategists to a recognition that higher functionality in the set-top is the way to go, Luff and others note. "If you look back six to nine months, you find most companies were leaning toward an architecture with dumb set-tops and centralized processing at the headend," he says. "But today people are realizing what can be done through downloading of software to a more intelligent set-top and what that means to salability of services."

One demonstration of what the higher power means to expanding the reach for content developers came with the recent agreement between Scientific-Atlanta and Argonaut Technologies, a leading supplier of 3-D software in the PC and video game arenas. Pending completion of a final agreement, S-A's PowerTV subsidiary will offer Argonaut's BRender 3D software as an optional component with rollout of PowerTV's digital set-top operating system later this year.

"One of the reasons we did this deal is that our customers were pushing back on us to provide for an expanded graphics capability," says Michael Bloom, general manager of PowerTV. "This is really in response to those requests."

The Argonaut software supports development of interactive three-dimensional applications for PCs and game players using a combination of buffering, perspective texture mapping, rapid scalability and an "intuitive" application programming interface. "This software supports a stunning presentation to the consumer," Bloom asserts.

He notes that most people assume that to achieve the level of graphics supported by Argonaut they would consume considerable "real estate" in RAM and would require additional hardware-based acceleration, but the Argonaut connection will permit a software-only solution that is far less RAM-hungry.

The PowerTV operating system, which will be the standard operating system for S-A's digital set-tops, serves as an example of the thinking behind the evolution toward open interfaces and high-power boxes within DAVIC. The system manages and controls the terminal's enhanced graphics, client-server interactivity, broadcast signal decoding, real-time compositing of graphics and video and MPEG-2 transport and decompression. The system is expandable, depending on the level of RAM in the set-top, which can be anywhere from 2 megabytes to 8 megabytes, depending on customer requirements.

From the content suppliers' perspective, the potential synergies stemming from interaction of this type of platform with universal software tools is well demonstrated in the BRender application. Argonaut Technologies' parent firm, U.K.-based game-maker Argonaut Ltd., has been using the BRender system in advanced games such as Nintendo's Starfox and FX Fighter, which is a co-development project with GTE Interactive Media. "We have a cross-platform technology that can run on game players, PCs or set-tops," says Rich Seidner, head of U.S. operations for Argonaut Technologies.

The system allows content developers to work in a desktop environment to develop truly interactive fare in three dimensions, meaning that the objects in a frame change in all dimensions in real time in response to user commands, Seidner says. "Typically, digital video is not interactive, it's hard to move around," he notes. "Working in 3-D eliminates this problem."

Opening the server environment

The same principles of access and portability extend to the server environment, of course. Here, too, the push toward compatibility is now focused on the interface "hooks" that are required to ensure development of the widest possible variety of content.

The ability to constantly update content that sits on a server, whether it's entertainment, news or something else, is the starting point for opening the platform to content developers, but it only recently emerged as a key area of concern for DAVIC, Luff says.

"In our first year we were focused on ensuring the system works in the relatively closed trial environment, where the operator is the one putting the services on the platform," Luff explains. "Now the goal is to open access to a larger media environment, which is a key question we're addressing in our second request for proposals. It's an extremely complex issue involving conversion of multiple media formats as well as the actual means of transport."

While Digital's media server platform already supports remote loading, changing content in real time remains a "bit of an issue," Lachiusa says. But, more importantly, he notes, "where it's really lagging is in agreement on a standard way of doing this."

Much of the work in this area is taking place within a group known as DSMCC, for Digital Storage Media Command and Control, which, like DAVIC, is a spinoff from the International Standards Organization's MPEG effort. "We're backing DSMCC," Lachiusa says, "but they've just gotten around to including this issue."

Nowhere is the pressure more evident for remote manipulation of server content "on the fly" than in the quest to make time-shifted on-demand TV programming a reality. "There's broad agreement that consumers' being able to see programs when they want to will be a major draw," says Al Kovalick, principle engineer for R&D at Hewlett-Packard's video communications division.

But, Kavolick adds, the scramble to accommodate supply of this particular killer app won't lead to overnight success. "This is just one of many areas where the industry has a long way to go," he says.

The good news is the rampup on the content side isn't confined to the low-return endeavors now underway to feed network trials. With the cross-platform compatibility now taking shape, content development in the consumer electronics sphere becomes part of the programming foundation for digital networks as well. CED

Standardization falls short of resolving the hardware cost issue for network operators

NCTA sets technical session slate

Forty-nine papers to be delivered in 11 sessions

Eleven technical sessions have been scheduled during the upcoming annual National Cable Television Association convention in Dallas this month, covering such topics as digital compression, network powering, system architectures, set-top box design and interoperability, among others.

During the show, the NCTA is making available a 400-plus page compendium of technical papers for $40 for NCTA members, $50 for non-members. Those who wait until the convention is over will pay $5 more for each copy to cover the cost of shipping. The book is considered a highly valuable technical reference text for engineering professionals.

What follows is the schedule of technical sessions that are planned for the convention. Consult the convention guide for locations of each panel discussion and for any last-minute changes in time or speaker schedules.

May 8, 1:30–3 p.m.

Network powering needs, plans and methods

Powering issues are more critical than ever as cable TV engineers map out systems and services for the 21st century.

Moderator: Joe Van Loan, Cablevision Industries

Panelists and topics: Tom Osterman, Comm/net Systems Inc., and Brian Bauer, Raychem Corp., "Hybrid fiber/coax network powering issues;" Doug Welch, Lectro Products, "Cable powering into a distributed load;" David Cushman, Power Guard, "Transmitting power in the '90s: Architectures and systems;" J. Gary Batson and Marty de Alminana, Power Guard, "Network powering: Achieving an efficiently powered plant;" and Carl Walker, Alpha Technologies, "The importance of UPS/generator compatibility for plant and headend protection."

May 8, 1:30–3 p.m.

Fiber optics performance review

The latest design and test methods for fiber optic cables, transmitters and receivers.

Moderator: Alex Best, Cox Communications

Panelists and topics: H. Blauvelt, I. Ury, P.C. Chen & T.R. Chen, Ortel Corp., "Return path lasers for high capacity HFC networks;" S. Ovadia, C. Lin & W. Anderson, Bellcore, and S. Heinz & R. Lee, Zenith Electronics, "Hybrid AM/16 VSB video lightwave transmission system in the presence of optical reflections;" Todd Jennings, Siecor Corp., "Putting fiber to the test: Practical field testing for fiber optic cables;" and Kerry D. LaViolette, Philips Broadband Networks, "Fiber by design."

May 8, 3:15–4:45 p.m.

New technologies for network reliability

The issues involving uninterrupted interconnection of broadband networks are explored.

Moderator: Dan Pike, Prime Cable

Panelists and topics: David Large, Media Connections Group, "User-perceived availability of hybrid fiber/coax networks;" Farr Farhan & Lee Thompson, Scientific-Atlanta, "Availability calculations and considerations in a broadband hybrid fiber/coax network for telephone services;" Peter Deierlein, Philips Broadband Networks, "Power supply reliability–causes of power supply failures and power supply reliability in CATV distribution equipment;" Chuck Merk & Walt Srode, Philips, "Reliability of CATV broadband distribution networks for telephony applications–Is it good enough?;" and Israel Switzer, "An optimum HFC network for telephony over cable TV."

May 8, 3:15–4:45 p.m.

Perspectives on system architectures

Experts view implications of multiple pathways to the next generation of systems.

Moderator: Russell Murphy, Family Channel/Cable Health Club

Panelists and topics: Don Gall & Paul Brooks, Time Warner Cable, "Considerations for development of existing CATV networks for future telecommunications services;" Ralph Brown, Time Warner Cable, "Video server architecture;" Jack Terry, Northern Telecom, and James Farmer, Antec, "Challenges and solutions in the introduction of digital services in home coax wiring;" and Dr. Richard Prodan, et al, CableLabs, "The cable system return channel Tx environment."

May 9, 9–10:30 a.m.

Designing for user-friendly interactivity

The technical challenges involved with creating a flawless "couch-to-TV" interface.

Moderator: Vito Brugliera, Zenith Electronics

Panelists and topics: Stacey White, General Instrument, "Graphical user interfaces: The success (or failure) to navigating the infobahn;" James Farmer, Antec, "Managing the return spectrum to optimize interactive revenue opportunities;" Steven Schlossstein, Interactive Health Network, "Intelligent user interface design for interactive television applications;" Albert Kim, Rogers Engineering, "Two-way CATV plant characterization;" and Mohan Mohankumar & David Ihnat, Zenith Electronics, "Authoring system for flexible and rapid development of on-screen display applications."

May 9, 9–10:30 a.m.

Maximizing operational performance

Improvements can be made to the broadband system to increase customer satisfaction.

Moderator: Jim Hughes, Belden Wire and Cable

Panelists and topics: Ted Hartson, Post-Newsweek Cable, "Minimal bandwidth upgrades;" Bruce Carlson & H. Pixley, CommScope, "Noise considerations in coaxial cable systems;" Louis Williamson, Time Warner Cable, "Conditional access and security considerations of transactional broadcast digital systems;" and Nicholas Worth, "Customer-focused service process improvement."

May 9, 2–3:30 p.m.

Set-top box design alternatives

Designers offer insights into set-top choices that will complement a system's budget.

Moderator: Jud Hofmann, Panasonic Technologies

Panelists and topics: Brian Zorc, Zenith Electronics, "Set-top box virtual memory concepts using multiple data streams;" K. Laudel, Applied Signal Technology, "Performance results of a low-cost alternative equalizer architecture for 64/256 QAM demodulation in a cable receiver;" Paddy Rao, Hyundai Electronics America, "Realistic architectures for multimedia set-top boxes;" and Caitlin Bestler, Zenith Network Systems, "The need for a single consolidated conditional access control system for analog and hybrid analog/digital addressable decoders."

May 9, 2–3:30 p.m.

Managing multimedia traffic in the cable network

Learn how to set up a cable system to efficiently and reliably transport multimedia traffic.

Moderator: Nick Hamilton-Piercy, Rogers Cablesystems

Panelists and topics: Mario Vecchi & Michael Adams, Time Warner Cable, "Traffic management for highly interactive transactional systems;" Ralph Brown & John Callahan, Time Warner Cable, "Software architecture for broadband CATV interactive systems;" Michael Adams, Time Warner Cable, "Fault tolerance in the Orlando Full Service Network;" and Gojo Strkic & Mark Chapman, Philips Broadband Networks, "Management aspects of a hybrid fiber/coaxial network."

May 9, 3:45–5:15 p.m.

Optimizing digital video delivery

Delivery methods are evolving in revolutionary times for service and network design. Insights from the lab and the front lines.

Moderator: Dom Stasi, TCI

Panelists and topics: Yasuo Harada, H. Hayashino, Y. Uno, T. Kumura & H. Mori, Matsushita Electric Industrial Co., "Digital video transmission system with pilot-aided C-OFDM;" Mauro Bonomi, Minerva Systems, "The art and science of digital video compression;" John Holobinko, American Lightwave Systems, "The future of regional digital network video transmission standards;" Michael Adams, Time Warner Cable, "Real-time MPEG asset delivery over ATM;" and Rhonda Hilton, CableLabs, "Protocols to support real-time applications over cable TV networks."

May 9, 3:45–5:15 p.m.

Regulated interconnection standards: The price of universality

Network interconnections, the Emergency Alert System and the interface to customers' equipment could all be highly regulated.

Moderator: David Large, Media Connections Group

Panelists and topics: Dr. Walter Ciciora, consultant, "The realities of the consumer electronic compatibility interface regulations;" Joseph Glaab, General Instrument, "History and present status of the decoder interface;" Robert Luff, Scientific-Atlanta, "Standards, standards;" and Shellie Rosser, Antec, & Marty Callahan, HollyAnne Corp., "Options for cable compliance with the new EAS rules."

May 10, 9–10:30 a.m.

Architectures for the info superhighway

This session gives different views of what the new Infobahn architectures will look like and also looks at some cybervehicles.

Moderator: Bob Burroughs, Panasonic Technologies

Panelists and topics: Don Grise, Bellcore, "Example interconnection of architectures, cable and telecommunications systems;" Rouzbeh Yassini, LANcity, "Using cable TV's HFC infrastructure for data communications;" Frank Koperda & Farr Farhan, Scientific-Atlanta, "Challenges with transmission of data over CATV networks;" and Lynn Jones, Digital Equipment Corp., "Internet access via cable TV: High-speed access to the information superhighway." CED

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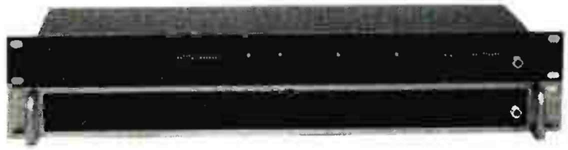

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Opportunity is knocking–will MSOs answer the door?

I thought you might enjoy a brief summary of my experiences with ordering, installing and activating an ISDN service, in my home, that's provided by my local telco.

Last fall, I found myself joining the ranks of telecommuters (people who work at home and communicate with co-workers, usually via the telephone network, using 9600 baud or lower-speed modems). My company was supportive of me having nothing less than the ultimate in high-speed data communications into and out of the home–enter ISDN (Integrated Services Digital Network), the highly touted data transmission service provided by the telcos which operates at a zippy 64 kbps.

It all began innocently enough when I contacted my local phone company, which just happens to be an RBOC with a strong ISDN marketing and installation campaign. The nice lady at the RBOC had no problem setting up standard business and fax lines, but didn't have a clue as to what ISDN was, or even who I should call. After several calls, transfers and holds, I finally got in touch with someone at my RBOC who knew what ISDN meant. Now, to get ISDN, one must be located within so many thousand feet of the central office, or an extension of the CO. I was assured that within several days a "loop qualification" would be performed, and I would be notified if ISDN was available in my neighborhood.

A couple of weeks later, I received a slick marketing package that highlighted all the marvels of ISDN and expanded on the RBOC's aggressive position on installing the service. But, no word on my loop qualification. Upon calling my RBOC, I was informed they had no record of me requesting ISDN, but I was assured they would enter the information, do the loop test and call me in a couple of days. Several weeks later (and still no word from my RBOC), I was attending a technical conference and happened to meet a representative from my RBOC. I explained my story and bluntly expressed my dissatisfaction. I must have spoken to the right person, because after returning home two days later, my RBOC called and informed me that I could, in fact, get ISDN in my neighborhood.

But this is just the beginning of a long series of chilling discoveries in the torturous adventures of ISDN acquisition. After being told I could get ISDN, I was asked a series of questions (flavored with many acronyms) as to how I wanted my ISDN line provisioned. I couldn't come close to answering most of the questions, aside from knowing I wanted 2B+D, and simply asked that they "just come over and hook me up."

However, I was told that this couldn't be done, since the RBOC can't supply me with an ISDN terminal. So I asked the natural question in response: "Where do I get ISDN terminals?" I was told that the RBOC couldn't recommend a vendor, either. I was then told to make sure I had an "NT1," otherwise, the ISDN service wouldn't work. "Where do I get this?," I asked. The RBOC couldn't tell me that either, but I was told that some vendors have it built into their equipment. Of course, my RBOC also couldn't say which vendor does or does not. While I began my search for an ISDN in-home terminal, I had my RBOC install the additional cables for the ISDN line in my house–which cost about $250. The circuit was then thoroughly tested and initially provisioned for a cost of about $170.

Now, even the mere mention of ISDN sends chills down my spine

Fortunately, my company knew of a reputable ISDN terminal vendor whom I contacted. I explained my situation to the salesman, who chuckled at the trouble I had experienced thus far. He had heard similar stories before, and said he could provide me with an ISDN in-home terminal for about $1,000. I simply needed to give him some basic information such as: What kind of switch is the telephone company using? How is the switch configured? My head spun as he asked a variety of other questions too acronym-intensive to even attempt to discuss here. It all seemed rather overwhelming, so I asked if someone from his organization would speak with someone from my RBOC (in acronymeze) to settle this matter. He basically said that they don't get involved with customer/RBOC interactions, but offered to have someone send me some information on ISDN provisioning and ordering that I could use to help clarify my confusion and allow me to converse with my RBOC. After a number of calls and faxes over the course of a week–back and forth between the vendor support staff, me and the RBOC–I had enough information to give to my RBOC to get my ISDN circuit properly provisioned.

Having accomplished this, my vendor salesman now assured me that the ISDN terminal he was sending me would contain the necessary software configuration for the particular telephone switch (an NT DMS-100). He assured me that in less than 15 minutes, I could interconnect the terminal to my computer, and the ISDN line would be up and functioning.

After receiving the terminal a few weeks later, I completed the necessary interconnections between the ISDN line, the ISDN terminal, my Macintosh and the Ethernet card installed within the Mac. But how would I get it to work? It wasn't entirely clear, so I attempted to read a floppy disk provided by the vendor to see if it contained some sort of clue. Unfortunately, the disk was unreadable, since it was formatted in DOS. A quick call to my salesman revealed that his company does not provide software for Mac usage and suggested that I call their technical support line.

The tech support person said it was critical for the computer to read the software to not only ensure the terminal was configured for the correct telephone switch, but also to enter the correct phone and SPID numbers into the terminal. Fortunately, I also have a home computer for personal use that is DOS-based, and I was able to reconnect some cables and "talk" to my ISDN terminal using my PC. At this point, I wasn't surprised to discover that the terminal had in fact been configured incorrectly–it was set up for an AT&T 5ESS switch. The vendor's tech support person was kind enough to walk me through the rigors of reconfiguring the ISDN terminal.

Incidentally, my company's office location which I'm dialing into (several states away) has similar ISDN terminals. Employees there, too, had to go through many of these same procedures. But at this office, there's an entire group of MIS computer hackers who, in a demented sort of way, live for this kind of thing. Even my vendor technical support person admitted that she mainly talks to individuals from MIS departments and not with ISDN illiterates such as myself. Unfortunately, I don't have at my disposal an array of computer geeks who could easily figure out the multitude of parameters involved with ordering, installing and initializing an ISDN link.

Now, even the mere mention of ISDN sends chills down my spine. No customer should be subjected to this aggravation. At times throughout the ordeal I felt I had no other recourse but to step outside and yell profanities in the general direction of my RBOC's central office. But it's not the fault of my RBOC, nor is it the fault of my vendor. It's the system. It's just the way things are done.

It's estimated that more than 10 million people now work at home. That number is estimated to reach as many as 40 million by the end of this decade. According to Negroponte, the Internet has between 20 and 30 million users and is experiencing double-digit growth each month. The more popular on-line service providers are also experiencing rapid growth and have multi-million subscriber bases. Couple this with the increased usage of graphic-intensive applications, and the need to transfer large-sized leads, to a strong demand for higher speed connectivity. Modems operating at 9600 baud just don't cut it any more. I do believe ISDN is a good alternative, but struggling for months to activate the service (at a cost of around $1,400), and then paying more than $100 per month in usage charges makes one wonder if it's really worth it.

The experiences of those getting ISDN service from the telcos, coupled with the growing demand for high-speed data services, illustrates a legitimate opportunity for the cable TV industry. I believe cable operators can take on the RBOCs and provide a superior quality of service. Cable operators need to commit their organizations to delivering high-speed data services at a lower cost, with faster installation times, while taking away all the senseless steps inflicted on us poor telecommuters and Internet surfers who just want to have a "simple" ISDN service (or something faster) without having to become a datacom guru/telephony expert/computer whiz kid in the process. I'm ready to switch. Is cable ready to provide?

Name withheld by request

The rewards of rural life

The cable was jerked out of my hand just as I was about to attach it to the P-hook. Turning quickly to see what had happened, I noticed the cable was wrapped around the leg of the biggest steer you ever saw. I'm wondering, "Oh Lord, what's going to happen next?"

You might think I'm kidding, but I'm serious; this really happened. This and much more. From the steer, to a moose kicking out my buddy's windshield, to a deer running into my vehicle, to the bullet hole in the amplifier, to the farmer pulling down the cable with his combine. These are just some of the situations the rural cable tech encounters on a daily basis–not to mention all the same sorts of problems the urban cable tech is familiar with.

As you can tell, in addition to being willing and able to do installs, run service calls, perform plant maintenance, CLI, proofs, install satellite dishes and do any number of jobs that are usually handled by several different people in large metro systems, my most important attribute is a good sense of humor.

I'd be willing to bet that most rural cable system operators are grateful to the larger MSOs for providing the training their techs have acquired. I have worked for many such companies with good training programs, including ATC, Prime Cable and WEHCO video. WEHCO had far and away the most rigid and in-depth training I have ever received.

But to be happy working in a rural system, you need to work for a company that understands the different qualities that are required from its techs, and which shows its appreciation of the dedication that is so often hard to come by in today's workforce.

In my current position as manager/tech with Renaissance Cable of Kentucky, my Vice President of Operations, Larry Bunnell, does his best to provide the tools to make my job easier, such as a gas-powered drill for pole change-outs, a nice field strength meter and a willingness to listen. That's not to say I don't have a wish-list–such as a bucket truck, more money, more help, more money, a four-wheel drive vehicle, more money–you know, all the things we all want.

But after everything is said and done, the one skill that is required of all rural techs is the ability to work without supervision. When a tech works via phone and fax, the home office needs to have confidence in the tech–that he is performing in a professional manner. Around here, you need to be proficient. It's not like the big city. In a rural area, we see our customers every day: in church, at the grocery store and any number of other places. You must take care of them; otherwise, you will be avoiding them.

The bottom line is this: If you're tired of the city and want a rewarding job where customers are your friends, rural techs are in demand all across the country. Just make sure all your questions and needs are addressed up front, and try to hook up with a group that appreciates your dedication, because dedication is what it takes.

Clif Moudy
Renaissance of Kentucky

The following technical companies will be exhibiting at the National Show Cable '95, as of March 30, 1995:

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AT&T 7007

ATCI/Antenna Tech. Comm., Inc. 9306

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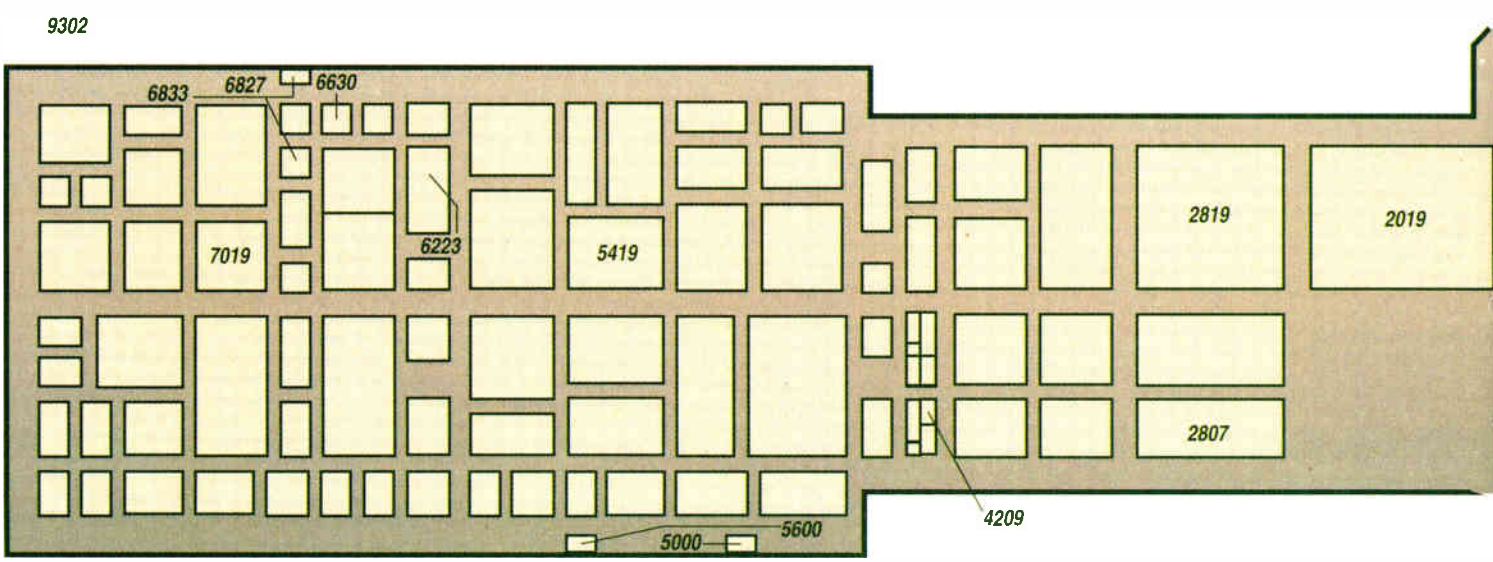

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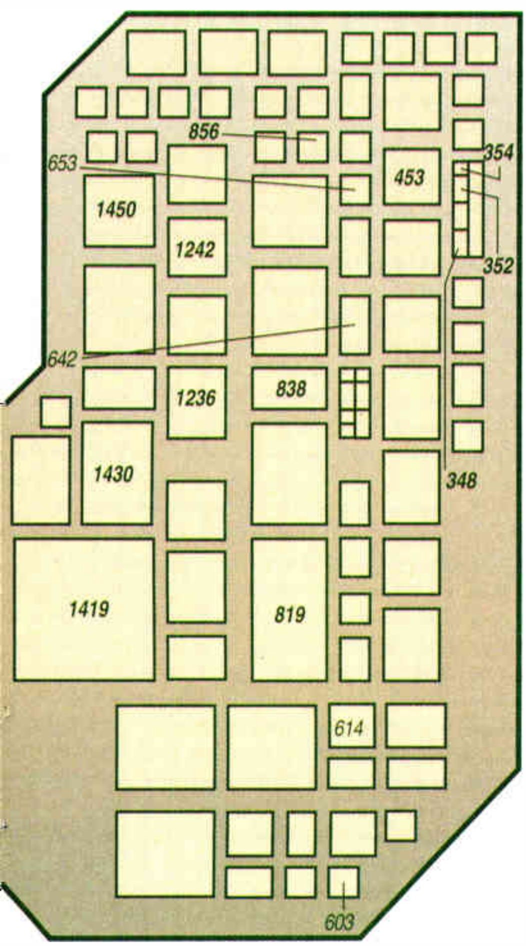

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Belden

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Phone 800/235-3362
Belden is the first ISO 9000 registered manufacturer of coaxial drop cable for the Broadband market. Belden recently completed a major capacity expansion project with further plans for expansion in 1995. Belden also offers a loose tube fiber optic trunk cable in armored and all dielectric versions from 4 to 240 fibers. Belden manufactures headend, audio, and plenum cables.

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General Instrument Corp. 2019
Phone 800/523-6678
General Instrument presents di GI tal TV –end-to-end systems solutions for broadband communications. This includes DigiCipher® digital compression, the full line of Cableoptics® fiber optoelectronics and lasers, the Broadband TeleCommunications Architecture, and the world's leading line of addressable set-top terminals, including the CFT-2200 with advanced on-screen graphics and the DigiCable™ DCT-1000 digital decompression terminals.

Gilbert Engineering Co. Inc. 242

Harmonic Lightwaves 642
Phone 408/970-9880
Harmonic Lightwaves will display its integrated family of 750 and 860 MHz broadband transmission and network management products. Designed to provide complete system solutions in any network architecture, these products include:
- YagLink™, the industry's most powerful externally modulated Nd: YAG laser transmitters.
- PWRLink™ DFB laser transmitters. Optical receivers for bi-directional broadband communications.
- NMS, a powerful network management system.

Hewlett-Packard Co. 1450
Phone 707/577-4100
Hewlett-Packard will have on display a comprehensive offering of cable TV test and measurement products, and network-monitoring systems. Also on display will be hardware that will enable customers to have two-way services in the home. This includes set-tops, video servers and computer systems for billing and tracking.

Hughes Communications, Inc. 5030

IBM Corporation 4603

IPITEK 9323

Integral 614
Phone 800/527-2168
Integral will be offering factory tours and product demonstrations during the NCTA show in Dallas. The factory is about 10 minutes from the convention center. Stop by the Channell Commercial Corporation booth #614 for details. Integral manufactures high density polyethylene products such as: Pre-assembled Cable-in-Conduit (CIC), Rope-in-Duce, Service Drop-in-Duct and Drop-on-Duct, Aerial Mesenger-on-Duct. Integral also produces "Lubaduk" with microspheres: the amazing "rolling friction" cable pulling lubricant.

Intel Corporation 1438

Jackson Tool Systems, Inc. 4307

Jerry Conn Associates, Inc. 6430

Jones Computer Network 7407

Jones Education Networks 7407

Kennedy Cable Construction 348
Phone 800/673-7322
Stop by Booth #348 and visit Kennedy Cable Construction, Inc. We have been serving the telecommunications industry for over 21 years! Aerial and underground line construction of CATV, LANs, telecommunications and fiber optic systems. Splicing, upgrades, rebuild, new extensions of system, balance, sweep and proof system. We will be glad to discuss all of your construction needs.

LANcity Corporation 256

Lectro Products, Inc. 6630
Phone 800/551-3790
We are featuring a whole new modular approach to network powring using our renowned ZTT with specialized low profile cabinets. This method allows you to make your most efficient powering decisions.

Lemco Tool Corporatiion 161

Lightspan Part., Inc., The 1258

Lindsay Specialty Products 4314

Macrovision Corporation 142

Microsoft Corporation 7025

Microware Systems Corp. 8915

Mind Extension University 7407

Mitsubishi Elec. America, Inc. 8522

Motorola, Inc. 1462

NCA Microelectronics 8538

Northern Telecom 842

Ortel Corporation 1459

PPC 1056

Philips Broadband Networks, Inc. 2807
Phone 315/682-9105
In booth 2807 at Cable '95, The National Show, Philips will exhibit The Media Pool™ video server, Media Access™ digital converters, the BCG™ Broadband Communications Gateway, Net-Prophet™ Network Monitoring System and the Spectrum 2000™ series of RF amplifiers. Featured are the new Diamond Net™ fiber optic receiver and the complete Diamond Line™ AM and FM fiber optic receivers and transmitters.

Photon Systems Corp. 8602

Pico Products/Pico Macom 636

Pioneer New Media Tech., Inc. 819
Phone 310/952-2111
In the rapidly evolving world of cable television Pioneer delivers. Since 1977, Pioneer has delivered on its commitment to provide CATV operators with advanced equipment and technical solutions. From our new BA-V1000 "Command Station" Home Terminal, to the most advanced Video Servers, Digital LD, MPEG2 Chips, and Near-Video-On Demand Systems, Pioneer delivers. Come see how Pioneer is helping to set tomorrow's CATV standards today. NCTA Booth #819.

FIBER OPTIC CABLES
OPTICAL COMMUNICATION SYSTEMS

Pirelli Cable Corporation 5600
Phone 803/951-4800
Pirelli will be displaying its quality fiber optic communication cables and CATV transmission systems in booth #5600. Pirelli is an ISO 9001-registered manufacturer of 4-264 fiber aerial, duct and direct buried loose tube cables; 288-432 fiber RILT™ (ribbon in loose tube) cables; and 1-96 fiber interconnect/riser cables. CATV transmission systems include linearized 1550 nm links using high power EDFA technology for headend and other applications.

Power Guard 2819

Rainbow Technology 8237

Reliance Comm/Tec 4830

Ripley Co./Cablematic Division 354
Phone 203/635-2200
Ripley designs and manufactures high quality tools for preparing ÇATV cables for splicing and termination. Among the products manufactured are hex crimp tools, Raychem, EZF® assembly tool, combination coring and stripping tools, jacket stripping tools, drop cable trimmers, conductor cleaners, F-connector insertion tools, cable duct cutter and fiber optic tools.

SCTE 6833
Phone 610/363-6888
Soon to be known as the Society of Cable Telecommunications Engineers, (we're changing our name to better serve a changing industry) SCTE offers a wide variety of technical training opportunities, including our Cable-Tec Expo and Emerging Technologies national conferences, regional seminars, in-house training services and educational videotapes and publications.

SITEL Corporation 6800

Sadelco, Inc. 740

Scala Inc. 6807

Scientific-Atlanta 1419
Phone 800/722-2009
At Booth 1419 at the National Show, Scientific-Atlanta will be exhibiting its full range of broadband communications products which make S-A the foc of convergence. These products include the following:
• A prototype MPEG-based digital home communications terminal.
• Interactive analog 8600x home communications terminal operating live with interactive program guides and other applications, NMOD capability, virtual channels and other new features.
• Coaxiom providing live telephone service over Scientific-Atlanta's Fiber-to-the-Serving Area (FSA) hybrid fiber coax networks.
• Digital storage and retrieval system for ad insertion and other applications.
• MPEG-based digital headend video compression system over satellite.
• 750 MHz distribution and fiber electronics.
• Scientific-Atlanta developed adapter with live downloading of Sega games from Sega Channel to Sega game players.
• DMX digital audio service with DMX On Screen of 8600x terminal.

Sencore 8516

Sharp Electronics Corporation 8236

Siecor Corporation 140

Siemens Stromberg-Carlson 411

SkyConnect, Inc. 448

Sony Electronics Inc. 1656

Southwestern Bell ....

Stanford Telecom 8325

Suntech Systems, Inc. 6301

Superior Elect. Group, Inc. 856
Phone 813/756-6000

The Cheetah™ System, manufactured by Superior Electronics Group, Inc. is an integrated network management system that provides full status monitoring and automated FCC Proof-of-Performance testing. Cheetah monitors CATV headends, fiber nodes, power supplies, amplifiers and end-of-lines.

Synchronous Comm., Inc. 6203

TV/COM International 8104

Tandem Computers 8704

Tektronix, Inc. 5800

Telecorp Systems 4214

Telect 9326

Teleport Communications Group 1003

Telewire/ANTEC 2819
Phone 708/439-4444

TeleWire Supply–the combination of Midwest CATV and Just Drop–is a leading supplier of the wide variety of products needed to build and maintain a cable television manufacturers to meet the ever-changing requirements of today's broadband networks. Product categories include drop and installation material, aerial and underground construction hardware, tools and safety equipment, taps and passives, fiber cable and apparatus, headend and distribution electronics, and coaxial cable. TeleWire and its nucleus of experienced cable professionals have traditionally focused on supplying and servicing regional markets. In addition, TeleWire also maintains multiple sales and warehouse locations, linked by a sophisticated on-line computer system, combine to form a strong national distribution network capable of assembling and shipping orders both rapidly and economically throughout the country.

Tellabs 6223
Phone .... 708/969-8800 Ext. 8394

Tellabs designs, manufactures, markets, and services voice and data transport and network access systems that are used worldwide by providers of communications services. The CABLESPAN™ 2300 Telephony-Over-Cable Transport System is part of a new Tellabs product family designed specifically to meet the unique demands of cable TV operators. The CABLESPAN system allows operators to increase the value and potential of their existing hybrid fiber-coax networks by offering telephony plus new services such as telecommuting, videoconferencing, and access to information services.

Telpar Inc. 8155

Texscan Corporation 425

Time Manufacturing Co. 9302
Phone 817/776-0900

Put your operator two feet closer to that hard-to-reach splice. An aerial lift that provides provides line access from 3 sides of the bucket, eliminating expensive rotators. Positive hydraulic bucket leveling gives a solid, stable work platform, leading to increased productivity and greater worker satisfaction. The VERSALIFT TEL-29NE. for more information, stop by Booth 9302.

Times Fiber Comm., Inc. 1242
Phone 203/265-8500
800/677-2288

Times Fiber Communications, Inc. coaxial cable supplier standardized on 1 GHz bandwidth for trunk, feeder and drop cables, featuring T10 semi-flex, TX10 low-loss and T-10 drop cables with life Time. Times Fiber Communications...where technology meets the bottom line. Stop by to see us at Booth 1242.

Toner Cable Computers 6212

Toner Cable Equipment, Inc. 6212

Trilogy Communications, Inc. 5000
Phone 800/874-5649

Manufacturer of exceptionally high quality, low loss, MC[2] air dielectric trunk and feeder cables, ideal for fiber-rich architectures aimed at Telco and CATV applications. Also offering a full line of quality drop cables including UL listed and corrosion protected, as well as Radiating and 50-Ohm hardline cables for wireless and RF communications.

Universal Electronics Inc. 8300

VITAC ....

VLSI Technology, Inc. 8616

Vela Research, Inc. 8715

Video Data Systems 640

Viewsonics, Inc. 4701

Vuescan, Inc. 806

Vyvx 7003

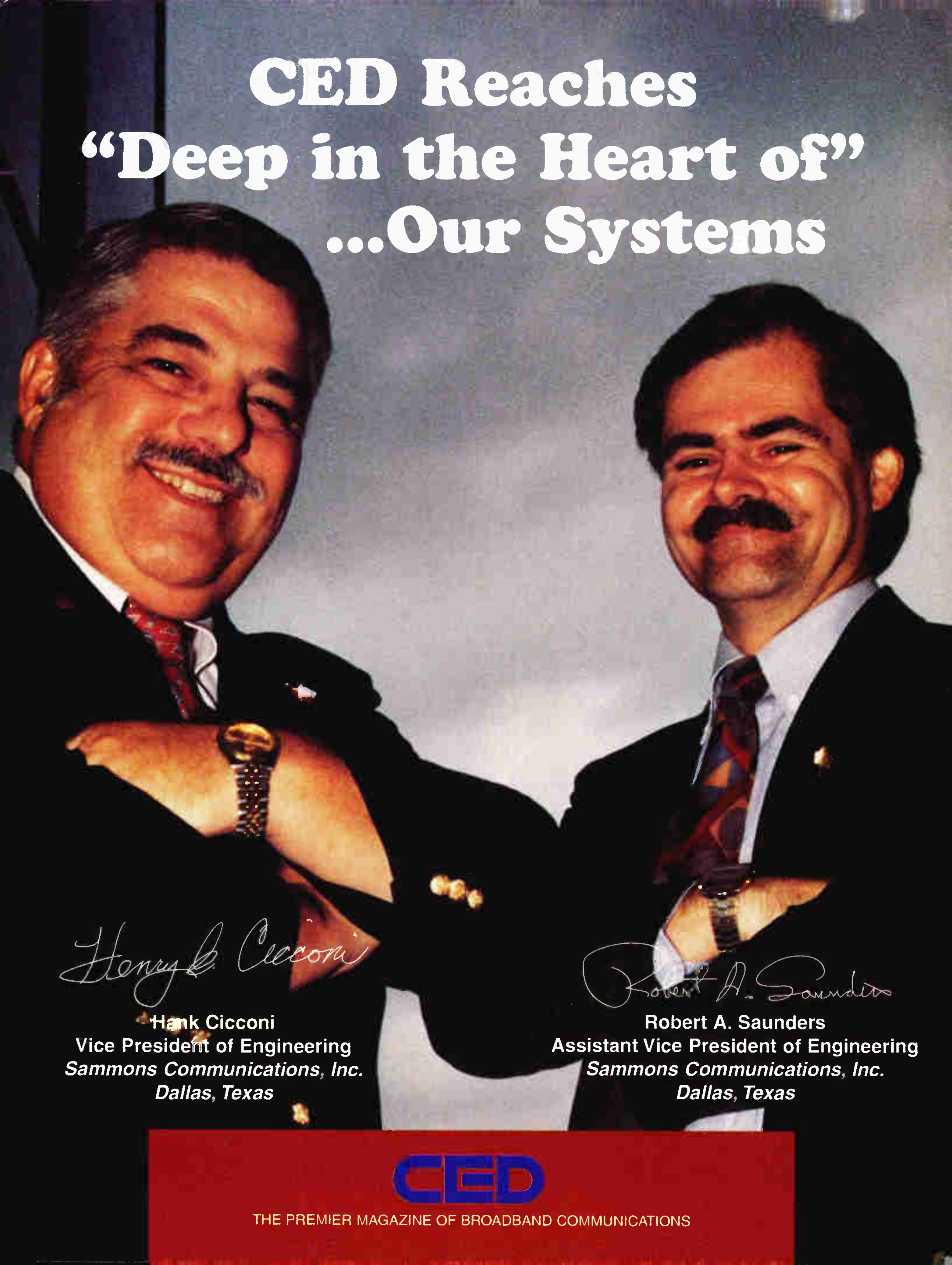
Wegener Communications, Inc. 4312

WEST END
A Newbridge Company

West End Systems Corp. 352
Phone .613/623-9600
WEST END Systems Corp., an affiliate of Newbridge Networks Corporation, develops and markets ACCESS and TRANSMISSION products for the Cable TV and Telecommunications industries. Its WestBound 9600 Broadband Access Platform incorporates an advanced RF transmission technology (OFDM) to deliver voice and data communications to business and residential users via BROADBAND HYBRID/FIBER COAX networks, and its Janua series of Modular Packet Access Feeders provide managed access to frame relay, X.25 and ISDN networks. West End has corporate offices in Kanata, Ontario, Canada, regional offices in Herndon, Virginia, USA and Newport, Wales, UK, and R&D facilities in Arnprior, Ont., Canada.

ZENITH
WATCH US.

Zenith Electronics Corp. 1430
Phone 708/391-8000
Fax 708/391-8569
Zenith is recognized as a leading provider of cable and data communication products for cable TV and telephone companies. Showcased at the Zenith booth will be addressable MultiMedia analog and Media Access™ hybrid set-top systems featuring real-time, interactive two-way communications and on-screen programs guides and displays. Featured will be ScreenPlay™, an authoring tool that dynamically creates and modifies interactive television screens to support unique requirements and new services. Zenith's MetroAccess™ system for data communications over coax and hybrid fiber/coax features powerful products for distance learning, work-at-home, telemedicine and on-line service applications. Zenith's rugged 16-VSB digital technology and its various uses will be demonstrated at several locations throughout the show.


CED Reaches
"Deep in the Heart of"
...Our Systems
Hank Cicconi
Vice President of Engineering
Sammons Communications, Inc.
Dallas, Texas
Robert A. Saunders
Assistant Vice President of Engineering
Sammons Communications, Inc.
Dallas, Texas
CED
THE PREMIER MAGAZINE OF BROADBAND COMMUNICATIONS

The issue: Utilities and outages

WIN $50 for responding*

Utilities are increasingly being looked upon as a potential ally for cable operators in the upcoming competitive era. Theoretically, at least, cable systems should work closely with utilities to help achieve a high level of reliability as they prepare to offer new advanced services and compete with telephone companies. We'd like your comments on the subject.

The questions:

1. How would you describe the relationship between your system and the local power utility company?

❑ Nonexistent ❑ Good ❑ Poor ❑ Don't know

2. Do you think allying with the local power company would bring your system any benefits (reduced pole rates, revenue from new services, etc.)?

❑ Yes ❑ No ❑ Don't know

3. Would your system be interested in performing remote meter reading and other telemetry operations for the local utility?

❑ Yes ❑ No ❑ Don't know

4. How would you rate your local utility company's overall reliability?

❑ Excellent ❑ Good ❑ Poor ❑ Don't know

5. Are you familiar with the purpose and goals of "CableUCS"?

❑ Yes ❑ No ❑ Don't know

6. How many outages does your system suffer in a typical month?

❑ 1 ❑ 2 ❑ 3-5 ❑ More than 5

7. What is the primary reason for your outages?

❑ Cable cuts/downed poles ❑ Power

❑ Weather ❑ Electronics ❑ Other

8. Do you think your system could do more to reduce the number of outages it experiences?

❑ Yes ❑ No ❑ Don't know

9. In comparison to last year, has your system reduced the number of outages it suffers, on average?

❑ Yes ❑ No ❑ Don't know

10. Does your system intend to someday provide telecommunications services (voice or data) over the cable TV network?

❑ Yes ❑ No ❑ Don't know

11. How important is it to your system's management that your system achieve the 99.99 percent reliability benchmark (53 minutes of outage per year)?

❑ Very ❑ Somewhat ❑ Not at all ❑ Don't know

Your comments:

Fax us at:

303-393-6654

Make a copy of this page and fax it back to us at the number above, or mail it to *CED*, 600 South Cherry Street, Suite 400, Denver, Colo. 80222.

*Every month, we'll pick one response from those we receive and award $50. See official rules below.

Names won't be published if you request your name to be withheld, but fill out the name and job information to ensure that only one response per person is tabulated.

Your name and title

____

____

System name:

____

Location:

____

Your MSO:

____

Your job function:

____

Daytime phone #:

____

Official rules: No survey response necessary. Enter by returning the completed survey via fax or mail to the locations indicated above, or print the words "CED Return Path" on a 3"x5" card and mail it along with your name, address, daytime phone number and signature. To be eligible for the drawing, entry forms must be received by 5 p.m. on June 30, 1995. CED is not responsible for lost or misdirected mail. One entry per person. Forms mutilated, illegible or not in compliance with these rules shall be considered ineligible in the sole discretion of the judges. Odds of winning depend on the number of entries received. A random drawing from eligible entries will be held on or about July 1, 1995. Winner will be required to provide his/her social security number and proof of identification and is solely responsible for all federal, state and local taxes incurred. Prize is not transferable to any other person. Sweepstakes participants agree to waive any and all claims of liability against CED magazine, Capital Cities Media Inc., Capital Cities/ABC Inc. and its affiliated and independent contractors for any injury or loss which may occur from participation in this sweepstakes or receipt of the prize. Winner consents to publication of his/her name for publicity purposes without further compensation. Participants must be 18 years of age or older. Employees of CED magazine, Capital Cities Media Inc., Capital Cities/ABC Inc. and its affiliated and subsidiary companies, and their respective employees, agents and independent contractors, and their immediate families are not eligible to participate. Void wherever prohibited, license required, restricted or taxed by law. Sweepstakes sponsors reserve the right to change or modify the sweepstakes rules while the sweepstakes is in progress. Participation in the sweepstakes constitutes acceptance of all sweepstakes rules.

RESULTS

After three years of testing their plants twice a year, half of those who responded to the survey reported that their systems are showing better results than a year ago, but a growing number say the tests don't reflect the overall performance of their entire systems. A year ago, 29 percent said the test didn't really reflect the overall health of their systems, compared to 36 percent who feel that way this year.

Outside of that, however, the results of the two surveys are almost identical. Half say they've made changes to their routine preventive maintenance schedules to accommodate the testing program, while more than half say they have all the manpower and equipment resources they need to get the job done. Major gripes continue to revolve around the amount of time it takes to perform the tests.

Test equipment vendors will be pleased to read that a whopping number of MSOs have purchased new test equipment that automates much of the testing and reduces service interruptions. However, respondents are still almost evenly split over the issue of disruption of service, while the number who think the industry would be better served by only having to test once a year grew by a small amount.

Interestingly, only about one-fifth say they have to show the results of their tests to a local franchisor, and even fewer report that they've been tested by an independent engineer who was hired by the franchise authority.

The issue: Proof tests

For more than two years now, cable operators have had to test the performance of their systems twice a year, once during the winter and again during the summer. While many systems have simply integrated this function into normal operations, for others, it remains a giant headache. This survey gauges how operators feel about the tests.

The results:

1. If you haven't already, soon you will complete another round of proof of performance tests. Do you think the test results mirror the overall performance of the entire system?

Yes	No	Don't know
57%	**36%**	**7%**

2. How do the results from this latest round of tests compare to results gathered one year ago?

Same	Worse	Better	Don't know
50%	**0%**	**50%**	**0%**

3. What's your biggest gripe about doing the tests?

Takes too long	Manpower	Interruptive
64%	**21%**	**14%**

4. Do you think you are given the proper resources (both manpower and equipment) to perform the tests efficiently?

Yes	No	Don't know
57%	**43%**	**0%**

5. Have you made any changes to your routine maintenance procedures since the advent of the tests a couple of years ago?

Yes	No	Don't know
50%	**50%**	**0%**

6. In your opinion, is the current method of testing too disruptive to viewers, even if those disruptions occur late at night?

Yes	No	Don't know
43%	**57%**	**0%**

7. Has your system over the past year purchased some of the new test equipment that automates many of the tests and reduces the number of service interruptions?

Yes	No	Don't know
79%	**21%**	**0%**

8. Do you think it's necessary to perform the tests twice a year, or would one annual set of tests be enough?

One's enough	Two's fine	Don't know
64%	**36%**	**0%**

9. Does your local franchise administrator require you to submit test results to him/her?

Yes	No	Don't know
21%	**79%**	**0%**

10. If so, has the local franchise administrator ever requested more information about the tests or consulted with you regarding the results?

Yes	No	Don't know
9%	**91%**	**0%**

11. Has your system been tested over the past year by an independent consultant or engineer hired by the local franchise authority?

Yes	No	Don't know
7%	**93%**	**0%**

Your comments:

"These tests have caused me to sweep only pre-selected legs of our cascade, and some cascades have never been swept since I started three years ago. I see this as a problem."

– Mark Nagel, US Cable, Michigan City, Ind.

"Testing six or seven channels twice a year tells you nothing about your system. (Testing) in-band frequency response is a waste of time, and the 24-hour test–talk about worthless data. Maybe 25 years ago it meant something, but not today."

– Name withheld by request

"Test equipment should somehow be designed to do all tests without interruption of service during normal business hours."

– David Meszes, Cablevision of Cleveland

MAY

1-3 Fiber Optics 1-2-3, Installation, Maintenance and Design seminar. Produced by The Training Division at The Light Brigade Inc. Location: Irvine, Calif. Call Valerie Johnsen (206) 251-1240.

1-4 Fiber Optic Installation & Splicing, Maintenance & Restoration for CATV Applications. Produced by Siecor Corp. Location: Hickory, N.C. Call Lois Boynton (800) 743-2671 ext. 5998.

9-11 Broadband Communications Technology, produced by C-COR Electronics Inc. Location: State College, Pa. Call C-COR Technical Customer Services at (800) 233-2267 ext. 4422 for additional information.

10-12 Understanding ATM Networking Applications. Produced by the American Research Group. Location: Houston, Texas. Call (919) 380-0097 to register, or fax to: (919) 467-8797.

11 SCTE Satellite Tele-Seminar Program. Topic: Convergence (Part 1, from Expo '94). To be transmitted on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. Eastern time. Call (610) 363-6888.

12 Palmetto SCTE Chapter, Technical Seminar. Topic: Video, headend and system Proof of Performance tests and measurements," with Brian Reich of Tektronix and Terry Bush of Trilithic. Location: Martinique Hotel, Myrtle Beach, S.C. Call John Frierson (803) 777-5846.

13 Cascade Range SCTE Chapter, Testing Session. BCT/E Certification exams to be administered. Location: Portland, Ore. Call Cindy Welsh (503) 667-9390.

Trade Shows

May

7-10 National Cable Show, produced by the NCTA. Location: Dallas, Texas. Call the NCTA at (202) 775-3669.

28-31 Canadian Cable Television Association's Annual Convention & Cablexpo. Location: Halifax, Nova Scotia. Call Christianne Thompson of the Canadian Cable Television Association at (613) 232-2631.

June

14-17 SCTE Cable-Tec Expo '95. Location: Las Vegas, Nev. Call Anna Riker, SCTE, at (610) 363-6888.

15 Fundamentals of the Hybrid Fiber/Coax Network. Presented by the Scientific-Atlanta Institute. Location: Chicago. Call (800) 722-2009 (press 3) for registration between 8:30 a.m.-5:30 p.m. Eastern time, Monday through Friday.

15-19 General Instrument's Broadband Communications Network Design. This five-day course includes a high-level overview of the broadband communications network, with a special focus on operational theory and network design. Location: Dallas, Texas. Call Lisa Nagel, GI (215) 830-5678.

16-17 Interactive Broadband Delivery System Overview. Presented by the Scientific-Atlanta Institute. Location: Chicago. Call (800) 722-2009 (press 3) for immediate registration between 8:30 a.m.-5:30 p.m. Eastern time, Monday-Friday.

16-18 Broadband CATV Laboratory, produced by C-COR Electronics Inc. Location: State College, Pa. Call C-COR Technical Customer Services at (800) 233-2267 ext. 4422.

17 Big Sky SCTE Chapter, Technical Seminar and Testing Session. Topic and speakers TBA. BCT/E and Installer Certification exams to be administered. Location: Billings/Laurel, Mont. Call Marla DeShaw (406) 632-4300.

17 Dakota Territories SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: Watertown, S.D. Call Tony Gauer (605) 426-6140.

17-19 Fiber Optics 1-2-3, Installation, Maintenance and Design seminar. Produced by The Training Division at The Light Brigade Inc. Location: Kansas City, Mo. Call Valerie Johnsen (206) 251-1240.

17-19 Installing Fiber Optic Systems. Produced by EESCO Communication Systems. Location: Oak Brook, Ill. Call (800) 366-3638 to register.

22-24 The New York State Cable Commission/SCTE 21st Annual Northeast Cable Television Technical Seminar. Location: Roaring Brook Ranch, Lake George, N.Y. Call Albert Richards (518) 474-1324.

22-25 Fiber Optic Installation & Splicing, Maintenance & Restoration for CATV Applications. Produced by Siecor Corp. Location: Keller, Texas. Call Lois Boynton (800) 743-2671 ext. 5998.

23 Desert SCTE Chapter, Technical Seminar. Topic: "Distribution systems–BCT/E Category IV Tutorial." Location: El Rancho, Beaumont, Calif. Call Bruce Wedeking (909) 677-2147.

23-25 Digital Video and Fiber Optic Networking. Produced by C-COR Electronics Inc. Location: State College, Pa. Call C-COR Technical Customer Services at (800) 233-2267 ext. 4422.

24 Gateway SCTE Chapter, Testing Session. BCT/E certification exams to be administered. Location: St. Louis, Mo. Call Don Widaman (314) 272-3900.

Optical power meter

HICKORY, N.C.–Siecor Corp. has introduced the handheld OTS-110 optical power meter. The microprocessor-based tool performs testing on both singlemode and multimode optical fibers during installation, system qualification, maintenance and troubleshooting.

The OTS-110 measures absolute power levels from +3 to -70 dBm at 850, 1300, 1310 and 1550 nm using a high performance InGaAs detector designed for maximum sensitivity and minimum connector reflections. Attenuation testing, especially dual wavelength, is streamlined by entering a reference in non-volatile memory for each wavelength and reading loss directly from the display.

Loss results are displayed directly on the backlit LCD display. The graphic display makes operation easy and intuitive, and offers adjustable contrast to assist viewing from most any angle in virtually all lighting conditions.

The unit provides three powering options via an internal rechargeable nickel cadmium battery, replaceable AA batteries, and an AC adapter with low battery indication. It automatically switches between power sources without interruption. A selectable auto-off function helps conserve batteries.

Circle Reader Service number 57

MPEG decoder

DALLAS–Optibase Inc. has announced it will begin shipping the QuadStream, a new four-channel MPEG decoder. The QuadStream is aimed at system integrators of video-on-demand file servers.

The decoder is a VME-based, 6µ-sized board that includes four channels of MPEG-1 video decoding. It supports three stereo channels and one dual stereo channel for multi-lingual applications.

Up to 64 channels of MPEG-1 video can be delivered using a single rack mount VME chassis, multiple QuadStreams, a CPU card from Heurikon or Motorola and a disk array from Conners Peripherals.

In addition, the decoder system provides video-on-demand (VOD) and pay-per-view solutions for customers in the cable TV, lodging and entertainment and information kiosk markets.

Circle Reader Service number 58

980 nm pump

Matched analog detector

BURLINGTON, Mass.—Lasertron has announced an impedance-matched receiver module for use in high-performance CATV receivers: the QDIV. The pigtailed pin photodetector features a 75 ohm impedance-matching transformer housed in a hermetically sealed 14-pin DIL package.

The QDIV module offers better than a 10 dB power advantage over resistively-matched photodiodes, resulting in a reduction of post-amplification requirements. The module also features low intermodulation distortion, an essential requirement for high-performance analog and cable television applications.

By providing both the photodiode and an impedance matching network in a module, parasitics are reduced and analog receiver design is simplified. Optical input is supplied through an angle-polished, low reflection singlemode 9/125 µm fiber. The device can be used in the field with temperatures ranging from -40 degrees to +70 degrees Celsius.

Circle Reader Service number 59

Fiber optic adapters

HINSDALE, Ill.–Storm Advanced Technology Group has expanded its product line to include new SC fiber optic adapters. The product has the capability to adapt connector interfaces to new equipment, reducing costs by eliminating

SC fiber optic adapters

1480 nm Erbium-Doped Fiber Amplifier

SAN DIEGO, Calif.–Mitsubishi Electronics America Inc. has announced a variety of new products. A 980 nm pump laser diode module designed for long-haul fiber optic communications and cable television is now available from the company's Electronic Device Group (EDG).

The FU-222SLD pump laser module provides a lower noise pump source and has lower drive current requirements than 1480 nm pump lasers now on the market. It is manufactured using Mitsubishi all-MOCVD process technology and the company's MQW laser structure that results in lower threshold current, and therefore, higher efficiency than 1480 nm pump lasers, according to the company.

The module also features a hermetically sealed laser diode, with a built-in photodiode for monitoring optical output. The butterfly package has a built-in thermal electric cooler for temperature stabilization. The FU-222SLD is available in two versions–60 mW and 90 mW optical output power.

Also new from Mitsubishi is the ML78512 series discrete laser diode array, and the PD7869 series discrete photodiode array. The new arrays combine 10 laser diodes or 10 photodiodes on the same substrate. The technology provides higher data rates and high packaging density per discrete, which decreases the board real estate required for optical transmitters and receivers in multi-fiber designs.

The Electronic Device Group has also announced a 1480 nm Erbium-Doped Fiber Amplifier (EDFA). The FG-602S-T01 amplifier provides stable input response with a flat gain profile over an operating wavelength range of 1535 nm to 1565 nm. The EDFA consists of an erbium-doped fiber, which is the gain medium, bidirectionally pumped by two isolated 1480 nm pumps.

And finally, the company is introducing a new package that incorporates both a 1300 nm laser diode and an InGaAs photodiode in the same module.

This bidirectional module replaces fiber optic designs that use separate laser diode and photodiode modules, and can transmit and receive over the same fiber at a 1300 nm wavelength. This results in reduced size, more reliable design and lower cost, making the bidirectional module suited for FitL and lower-speed Sonet applications.

Circle Reader Service number 56

the need to re-terminate cable assemblies, according to the company. The adapters also protect the input/output ports of optical equipment from damage caused by repeated matings, and upgrade distribution panels.

Single mode adapters display an insertion loss of <.7 dB and a typical return loss of -45 dB. Multimode adapters' insertion loss is < 1dB. Stable through 50 matings, the adapters are available from stock for quick response delivery.

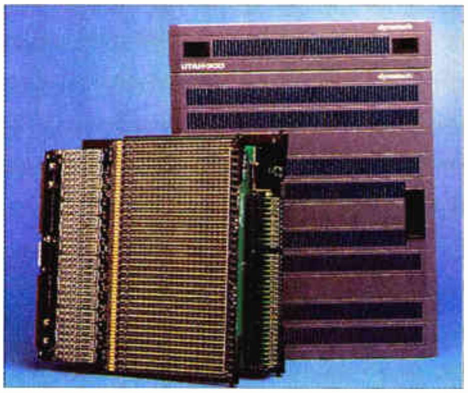
Circle Reader Service number 60

Routing system

SALT LAKE CITY, Utah–Dynatech Video Group has introduced the UTAH-300 routing system, featuring "Smart Architecture." Designed for efficiency and maintenance-free operation in medium to large routing switching environments, the Utah-300 represents the fourth generation of routing systems from Dynatech and the engineering teams of Utah Scientific and Alpha Image.

One notable design feature is the system's ability to handle analog and digital signals in the same rackframe, facilitating the move from analog to digital by swapping boards.

With an optional swap/sum module, the Utah-300 can combine adjacent audio channels into one, creating a mono signal from a stereo input for certain applications. In addition, left and right audio channels can be swapped, improving flexibility in post or live applications.


UTAH-300 routing system

The system also has small, wireless fans built into its frames, providing efficient cooling of the matrix frames. The fans are modular for easy replacement and consume less power than typical cooling fans in routing switchers today, according to the company.

Circle Reader Service number 61

Micro fusion splicer

SAN DIEGO, Calif.–Fiberlign, a Division of Preformed Line Products, has introduced a new micro fusion splicer for fiber installations, system maintenance and emergency restorations. The splicer, called "Merlin," features a disposable "electrode and precision V-groove" module that reduces downtime traditionally associated with regular field maintenance of critical components.


"Merlin," micro fusion splicer

Merlin also includes a fiber pre-load system which eliminates guesswork or reliance on visual inspection. The Sure-Touch fiber positioning system ensures that the fiber ends are easily and consistently positioned to produce optimum splicing results. LEDs identify when the fiber ends touch and when they are loaded to the precise pressure required for quality results, ensuring successful splicing.

The splicer is small and lightweight, measures 6.5 x 8 x 2.2 inches, and weighs less than five pounds.

Circle Reader Service number 62

T-Safe enclosure

FRANKLIN PARK, Ill.–Reliance Comm/Tec Corp. has introduced T-Safe, a new enclosure incorporating the Slam Lock automatic locking device.

The T-Safe may be used in most apartment complexes and dwellings where multi-cable service is available. It houses taps, splitters, couplers and assorted distribution equipment.

Slam Lock provides simplified use and assured security within distribution enclosures. To use the Slam Lock, the field technician places the door onto the backplate of the enclosure. Locking tabs engage as pressure is applied to secure the enclosure.

The Diversified Star Lock design on the head of the Slam Lock accepts only a Star Lock key for greater security to prevent unauthorized entry.

Circle Reader Service number 63

Connector polisher

SAN DIEGO, Calif.–GC Technologies has introduced a new fiber optic connector polishing machine capable of producing superior back reflection performance during field termination or service upgrade operations, according to company officials. The Model CT-9000 automatic, handheld polishing machine is designed for retro-polishing and will generate back reflection performance for most industry standard connectors in the range of -60 to -65 dB.

Model CT-9000 automatic, handheld polishing machine

No fiber cutting or special polishing skills are required to use the device.

The light weight of the CT-9000 makes it possible to polish directly at the equipment frame with less than two inches of dressed out cable. A convertible stand provides tabletop or rack-mounted operation as well, depending on the user's access to the patch panel. The unit is battery-operated and is packaged with the battery pack, charger and all consumables needed to complete the polishing procedures. GCT's recommended connector polishing procedures can be completed in less than two minutes per connector. A built-in timer knob on the CT-9000 will automatically shut the polisher off after the required pre-set polishing time.

Circle Reader Service number 64

MPEG-compatible

SUNNYVALE, Calif.–Philips Semiconductors has announced a new, digital MPEG-compatible video encoder, the SAA7185, which encodes digital YUV data to an NTSC or PAL CVBS and S-video analog signal to be displayed on consumer TVS or recorded on VCRs.

The SAA7185 is designed for use in video processing equipment such as video servers, computers, video CD players and video games.

The device accepts 16-bit YUV or 8-bit CCIR 656-compatible YUV data in MPEG format. It is controlled via an I2C serial interface or via an 8-bit microprocessor port and can be synchronized as master or slave to external devices.

Circle Reader Service number 65

OTDR emulation

UTICA, N.Y.–Laser Precision has announced the availability of PC-3000, a new OTDR emulation software program.

The program, which operates on any IBM or compatible computer, has all of the measurement and analysis abilities of an OTDR, eliminating the need to tie up valuable OTDR time to view and analyze traces saved to diskettes. The PC-3000 allows users to view, analyze and document OTDR traces that have been saved to diskette from a laser precision OTDR, mini-OTDR or FF-1000 series Feature Finder in the comfort of their office or lab.

PC-3000 can be used for review and documentation of installation tests, trace records management, batch analysis and printing of high count fiber installations, trace compare for restoration or maintenance tests and for downloading fiber analysis results to spreadsheet or database programs.

Based on FAS, Laser Precision's fiber analysis software, PC-3000 contains several advanced features for characterizing and comparing fiber traces.

Circle Reader Service number 66

MPEG-2 decoder

PALO ALTO–Optivision Inc. has announced the OPTIVideo MPEG-2 decoder, a playback card for PCS that will decompress broadcast-quality NTSC and PAL video and CD-quality audio from MPEG-2 encoded source material.

The decoder can decompress MPEG-2 and MPEG-1 compliant bitstreams, all from the single board, making the product a cost-effective solution for users who need to playback both types of MPEG recordings. Using an Intel i960 chip that offloads processing from the CPU, this single board solution will also allow users to install as many as four decoders in one PC.

Optivision is targeting professional users in the cable and broadcast markets who require higher quality MPEG source material for applications including video-on-demand and ad insertion.

For television applications, the decoder features a genlock analog video input so that MPEG-1 and/or MPEG-2 decoded video can be synchronized to an external reference video signal.

The decoder decompresses MPEG-2 video at full CCIR 601 (704 x 480 resolution) and 601 variants (544 x 480 x 352 x 480 resolutions). MPEG-1 source material is decompressed at the full Source Image Format (SIF) resolution of 352 x 240 pixels for NTSC.

Circle Reader Service number 67

Cooling capacitor cover

Water-cooling capacitor cover

NORWALK, Conn.–A water-cooling capacitor cover is new from COMET North America Inc. According to the company, the cover will provide as much as a 25 percent increase in capacitor current-carrying capacity.

Standard convection-cooled vacuum capacitors are cooled by the natural flow of air around the unit. Smaller capacitors will lose current carrying capability as temperatures increase.

Circle Reader Service number 68

Directional drills

NEWTON, Kan.–Straightline Manufacturing Inc. has announced the latest in its series of DirectLine horizontal directional drills, the DL905. A self-contained unit, the DL905 has a 35 hp Hatz diesel providing power to the track drive, drilling fluid delivery system, and the drill rack's robust thrust and rotary systems.

It can be configured with simultaneous drilling fluid delivery and mixing capabilities, allowing for uninterrupted bores. In addition, the new drill provides 9,000 pounds of thrust, 920 ft/pounds of torque, and 3,000 psi maximum drilling fluid pressure delivery. The DL905 is designed to directionally bore distances of 400-plus feet and pullback four inches and under product pipe, dependent on soil conditions.

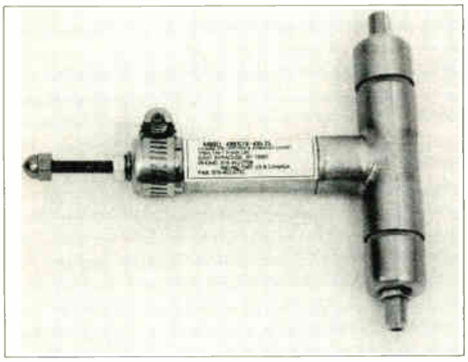
Circle Reader Service number 69

UHF notch

EAST SYRACUSE, N.Y.–Communications & Energy Corp. is announcing the Model 4001CTU, which suppresses unwanted UHF carriers between 470 and 890 MHz.

The filter is available at specified frequency add with 3 dB bandwidth options from 3 to 24 MHz for corresponding notches from 13 to 27 dB. Custom assemblies of two or more separate filters can be supplied with deeper notches and narrower bandwidths. The filter measures 10.5 x 8.5 by 2 inches and weighs 9.3 ounces. F connector (75 ohms) is standard. BNC (50 ohms) are available on special order.

Circle Reader Service number 70



Model 4001 CTU

Taps

LONGWOOD, Fla.–Multicom Inc. has announced that its new line of taps and passives are in stock. The outdoor devices are powder-coated, feature brass ports and cover a bandwidth of 5 MHz to 750 MHz. In addition, they are SA compatible. The taps are available in 2-, 4- and 8-way versions from 4 dB to 35 dB. Splitters come in 2- and 3-way balanced and 3-way unbalanced; directional couplers are 8 dB, 12 dB and 16 dB. The MPI8 power inserter is also in the line.

Circle Reader Service number 71

Optical transmitters

SANTA CLARITA, Calif.–Harmonic Lightwaves Inc. is announcing new versions of its YAGLink and PWRLink optical transmitters that are specifically optimized for 110-channel analog operation. The new YAGLink model number HLT 6700-FA, and the PWRLink DFB model number PWL 4700-FA offer the same advantages of the standard models, but provide improved CNR performance when carrying 110 channels. Both models are available now.

By taking advantage of the unique 10 log cascading rule for CTB, the YAGLink HLT 6700-FA can deliver up to 55 dB CNR fully loaded with 110 channels, providing improved picture quality over a transmitter optimized for 80 channels. Similarly, the PWRLink PWL 4700-FA can deliver up to 52 dB CNR with 110 channel loading.

Harmonic also announced improved performance of 1 dB CNR over previously published specifications for the standard YAGLink model number HLT 6720 with 80-channel loading. When loaded with 80 channels and 200 MHz digital carriers, the standard HLT 6720 YAGLink can deliver up to 58 dB CNR, taking advantage of the 10 log cascading rule.

The YAGLink is an externally modulated, high performanced broadband AM transmitter for fiber optic communications networks. The unit has been designed to provide a reliable solution for full deployment of fiber in both hub interconnects and fiber-rich local distribution networks.

Circle Reader Service number 72

Software package

INDIANAPOLIS, Ind.–Wavetek has introduced StealthWare, a Windows compatible software package providing maximum analysis, reporting and archival abilities for cable television managers, engineers and technicians.

Designed for use with Stealth SAM 4040 and Stealth System Sweep, StealthWare provides an analysis and reporting tool in an easy-to-use package.

StealthWare makes it possible to upload field measurements such as waveforms and automated test results from a Stealth instrument. These are stored in a relational database, eliminating the need to maintain separate files. Measurement waveforms are displayed graphically (similar to how they appear on the instrument) and can be copied and pasted into other Windows-based applications, or viewed in multiples.

The package simplifies automated testing. The user downloads an automated test configuration from his computer to his Stealth instrument, performs the measurements in the field and uploads the results to the software for viewing and analysis. Test results can be accessed through a spreadsheet format and easily sorted by location, date, time, measurement type or channel. When warning or alarm limits are applied to the test results, color coding indicates out-of-limit measurements. Test results can be exported to other Windows applications, or documentation can be generated with customized reports, complete with company logo.

Circle Reader Service number 73

Video, audio, data

SOUTH PLAINFIELD, N.J.–Radiant Communications Corp. has announced the availability of the DVL4E, a bi-directional singlemode video/audio/data system.

Applications for the DVL4E include distance learning, video teleconferencing and closed circuit television.

The DVL4E is a system that sends and receives video, audio and data signals over one singlemode fiber. This baseband unit has a dynamic range of 18 dB, which means that it can transmit signals over 50 km. Even at the maximum distance, the signal-to-noise-ratio will be greater than 50 dB.

Circle Reader Service number 74

Optical terminals

STATE COLLEGE, Pa.–C-COR Electronics Inc. has introduced a new series of 3.1 Gbps optical terminals as another member in its family of COMLUX Series 3000 digital fiber optic systems. The new product, called the 3700, was shown along with other Series 3000 system components, at the National Association of Broadcasters Convention in Las Vegas, Nev.

The new terminals are well-suited to the needs of a variety of applications requiring quality distribution of multiple video channels, such as broadcast television circuits, including swtiched video services, and CATV video distribution systems.

The Model 3700 will carry up to 32 video channels on one optical wavelength when used with C-COR 8-bit video codecs, and up to 16 channels with C-COR 9-bit or 10-bit video codecs. This doubles the number that could previously be carried, and when used with optical multiplexing devices, these capabilities could again be doubled–up to 64 channels of broadcast quality, uncompressed video on a single optical fiber.

The 3.1 Gbps optical terminals were designed as directly compatible, drop-in replacements for other optical terminals in the 3000 line, and can be used with all Series 3000 products.

Circle Reader Service number 75

Portable locator

RAYTOWN, Mo.–Rycom Instruments has introduced the new 8875 Portable Locator, capable of pinpointing buried cable, pipe, wire and faults. Featuring Push Button Depth, any buried conductor depth can be determined up to 15 feet. Also new is Absolute Signal Strength, which simplifies path identification. Since the receiver is positioned over the target cable, the highest number displayed in peak mode and the lowest number in null mode identifies the cable path. Absolute Signal Strength can also identify a loss of signal to ground caused by damaged cable, find insulated pipe bushings or locate shorted pipes.

The Portable Locator is also available in rechargeable batteries with an optional DC cigarette charger, which can recharge the batteries in two to three hours and can provide power to the transmitter directly from the truck.

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The good old days

By Archer S. Taylor, Director and Senior Engineering Consultant, Malarkey-Taylor Associates

Remember when radio was exciting? Back in the '30s and '40s, radio was the only source of entertainment many people could afford. We listened to Jack Benny and Rochester, to Fred Allen, to George Burns and the indomitable Gracie Allen, and to Edgar Bergen and his wooden friend, Charlie McCarthy. And don't forget Ed Wynn, "The Perfect Fool." Freeman Gosden, who played Amos of "Amos 'n Andy," commented that, "...Most [professional critics] did not realize that we were after the creation of character, not gags. . . You don't have to have a laugh in every line to be funny." Then came "Fibber McGee and Molly," "The Goldbergs," and the enormously popular "One Man's Family," about the family next door, if not your own family. Radio's genius was to excite the visual images created in the viewer's own fertile imagination.

Walter Damrosch almost single-handedly brought about a mass love of good music with the "Music Appreciation Hour," which led to the creation of the NBC Symphony Orchestra, conducted by the great Arturo Toscanini. Milton Cross introduced grand opera to the public. Serious radio drama was presented in the "Lux Radio Theater," "The Eveready Hour" and "The Fleischman Yeast Hour." Radio created the golden age of big band music: Guy Lombardo, Benny Goodman, Glenn Miller, The Dorseys, Wayne King, Paul Whiteman, Duke Ellington, Hal Kemp, Cab Calloway, Louis Armstrong, Eddy Duchin, and many others, ranging from syrupy-sweet, to smooth, danceable rhythms, to swing and New Orleans jazz.

The rising impact of PBS and cable TV

Times have changed. During the 1948-1952 FCC television allocation freeze, radio was thought to be in extremis, although not quite extinct. Who wants radio when "picture radio" is coming so soon? Fighting for its economic life, radio has survived by becoming the display case for recorded music, and the broadcast equivalent of the Union Square and Hyde Park "soapbox" pulpits for purveyors of causes and vulgarities, if not genuine pornography.

Kenny Rogers recently said that popular music, in the radio era, was about romance; today it is about frenetic passion. Except for Garrison Keeler's charmingly disorganized Lake Wobegon yarns, neither radio nor television today provides much exercise for the imagination. Television images are unequivocally explicit, whether it be a fiery explosion; a high-speed, tire-screeching, outlaw chase down congested city streets; murder or sexuality.

Public television (PBS), C-SPAN, CNN, and CNBC provide the penetrating news reporting and analysis once pioneered by broadcasters Ed Murrow, Chet Huntley and Walter Cronkite. To a large extent, PBS has become the major provider (with help from the BBC) of creative and intellectually stimulating drama, concerts and discerning documentaries.

Cable TV's C-SPAN, Discovery, The Learning Channel and other cable networks provide informative, educational programming that broadcasters disdain. Some think that even television broadcasting's "good old days" may be numbered.

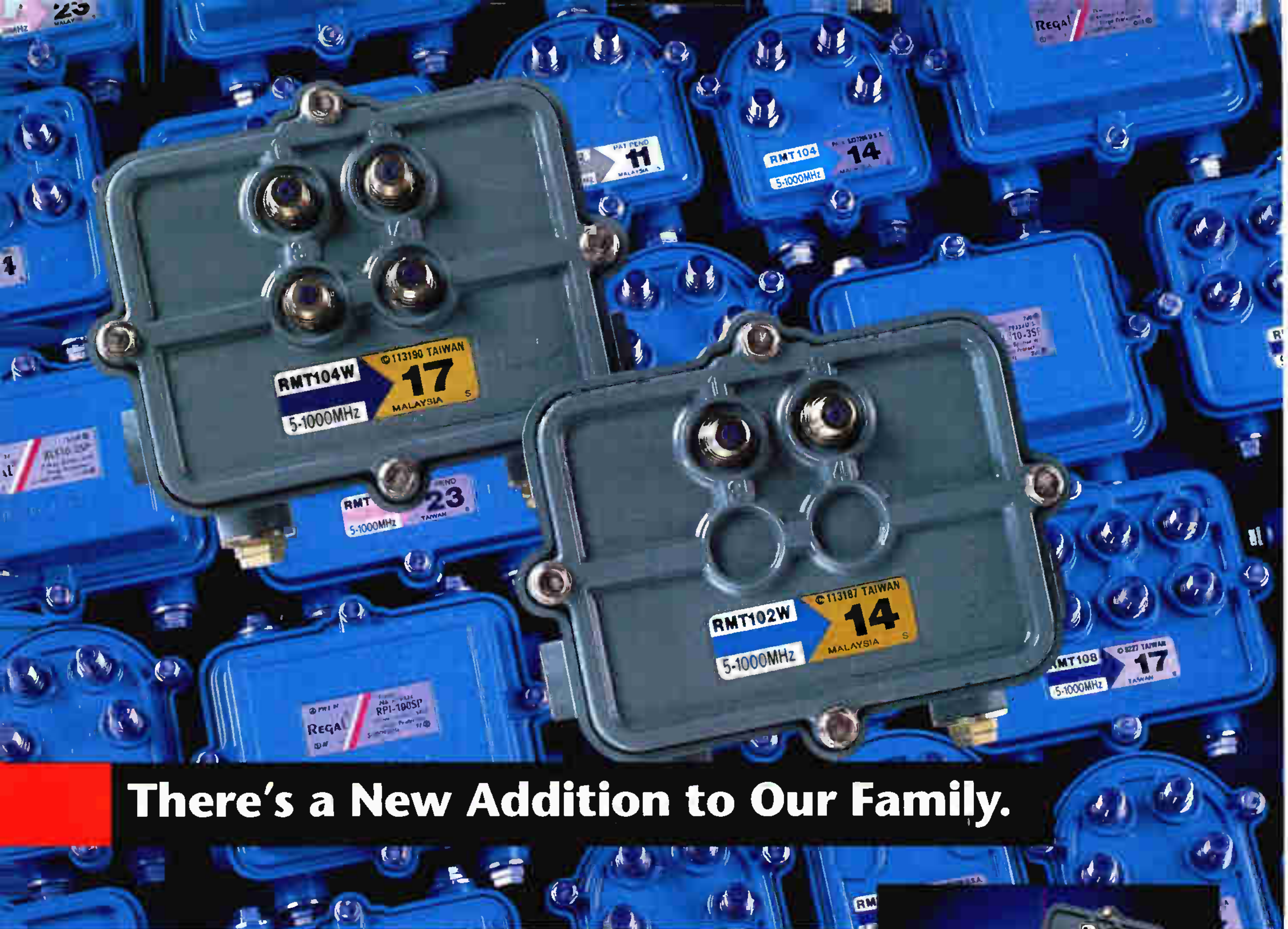
Both PBS and cable TV face daunting challenges. How well PBS can survive the politically inspired restructuring remains to be seen. Cable TV is beset with political attacks on its pricing strategy, and at the same time, competition for subscribers from the wired networks of the telephone companies, as well as wireless microwave and satellite distribution.

The interface challenge—interoperability

Times are changing for cable TV. The 1968 Carterfone decision eventually forced the Bell System to abandon its total control over the manufacture, sale and installation of the telephone sets connected to its network. That someday a similar rule would be applied to the cable TV interface should long have been expected. But, while telephone standards had to be defined only at the interface between the subscriber loop and the telephone set, cable TV standards are required not only for the interface between the cable TV drop and the interface box, but between the box and the subscriber's video or data receiving terminal.

Cable TV's "good old days" could be behind us if we resist for too long permitting subscribers to purchase or rent the interface from third parties. Interoperability is the defining word. Interface equipment purchased by a TCI subscriber in Omaha must work on Cox's system in Omaha, and on Time Warner's system in Orlando. It should also work with wireless cable (MMDS), direct broadcast satellites (DBS), multimedia computers, and yes, even with the video telephone networks. The crucial question is whether interoperability can be achieved by compromise and negotiation between the many interested parties, or whether it will be achieved de facto by the party (or parties) with the biggest and best positioned artillery (i.e., financial position and market power). If neither, interoperability will be decreed by Congress, the FCC and the courts.

The obstacles to amicable agreement are indeed awesome. The time is coming to an end when MSOs and individual systems could make independent decisions regarding program security, services offered, remote control and program recording features. However, it seems that the imminent advent of compressed digital transmission may turn out to be a most fortuitous opportunity. A high degree of security and scalability is more likely to be possible with digital encryption and an open architecture than would be feasible with analog technology. CED



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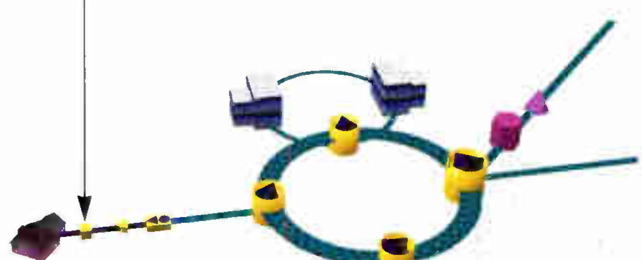

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